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FEATURE SECTION

Editor's Note. The articles in this feature section were invited by the Editor after consulting with Dr. Glenn Sonnedecker, Director of the American Institute of the History of Pharmacy, as to how a feature section could best serve pharmacy history. These critical bibliographical essays cover the areas of pharmacy, pharmacognosy, and pharmaceutical chemistry. The Editor is indebted to Dr. Sonnedecker for his coordination of this series.

SOME GUIDELINES INTO THE HISTORICAL LITERATURE ON PHARMACY

GLENN SONNEDECKER

Within the compass of a short bibliographic essay, we can put into the hands of teacher, pharmacist, or student an entering wedge into the historical literature about some main facets of pharmacy, but not more. This might be called a guideline to search rather than research.

The serious historical writer must look elsewhere for reference to his specialized bibliographies and other heuristic aids. If he finds here anything useful, it may be a convenient reminder of some storehouses for historical lumber, out of which new history can be built with tools of selection, evaluation, interrelation, and interpretation.

A bibliography describes or lists writings on a given subject, in this case "pharmacy." The Editor's invitation to contribute indicates that most of the scientific content underlying and interlacing pharmacy probably is being covered in other essays, no doubt including the main guideposts to historical literature on materia medica. Therefore we shall be concerned mainly with "pharmacy" in the sense of an organized and recognized professional service, although more general references and bibliographies splash over the whole field as well.

The character of a bibliographic essay further limits our scope and purpose. Thus we refer the reader to detailed lists, rather than offering them. This entails an obligation, however, to be not only highly selective, but to hazard occasional comments as to which publications known to the writer seem especially valuable.

The tendency, given a small space, is to cite bibliographies and general works rich in bibliography, often of a rather monumental kind. To use these keys to the historical literature, not to mention the literature itself, implies access to a good library. Some pharmaceutical libraries that have good collections of current literature feel they cannot enter the market for out-of-print literature, which looms so large in the following pages. Fortunately for many readers, recent years have mitigated this problem somewhat because of the perfected inter-library loan system, nominal postal charges for library materials, cheap and more extensive microfilm services, and methods of making book-sized photoprints costing little more than the microfilm from which they are made.

The photographic services of the National Library of Medicine have made friends among medical and pharmaceutical scholars world wide, who know this library as one of the greatest institutions of its kind in the world. Undoubtedly its historical collection on pharmacy is the best in the Americas, which puts its monumental printed catalog in the forefront of an introduction to general bibliographies.

GENERAL BIBLIOGRAPHIES

The *Index-Catalogue of the Surgeon-General's Library* (Washington, D.C.) has been published in four A to Z series beginning, respectively, in 1880, 1896, 1918, and 1936. From whatever historical viewpoint or topic one approaches pharmacy, "The Surgeon General" is a good starting point. It not only shows the holdings of the National Library of Medicine, as it is now called, but may be considered a universal index to most medico-historical journals that have been published. The first fifty-seven volumes contained approximately 3,357,-755 references. With Volume 58, "The Surgeon General" was discontinued in its traditional form (but see the *Armed Forces Medical Library Catalog* and the serial, *Current List of Medical Literature,* for a form of continuation).

A cardinal point to remember in using the four alphabetic series is that there is no significant duplication but there is extensive chronologic overlap (reflecting dates of acquisition rather than dates of publication). Even experienced users should find something of value in the authoritative article by Claudius Francis Mayer, "The Index-Catalogue as a Tool of Research in Medicine and History," in *Science, Medicine and History* (E. Ashworth Underwood, ed., Vol. II, Oxford University Press, Cambridge, 1953, pp. 482-493).

Among the bibliographies published serially overseas, perhaps the most comprehensive single source for historical references on pharmacy remains Karl Sudhoff's *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften* (adding, *und der Technik* from Vol. 31), which began in 1902 and suspended with Vol. 40 (1943). It includes a special rubric for materia medica, pharmacy, and toxicology.

Some of Sudhoff's predecessors remain useful in pharmacy, such as Albrecht von Haller (pharmaco-botany, in 1771-72); Ludwig Choulant (a "Handbuch" on antique medical works, in 1828); Alphonse Pauly (whose *Bibliographie des Sciences Médicales* . . . , Paris, 1874, however spotty for pharmacy, remained sufficiently useful to be reprinted in 1954 at London), and Julius L. Pagel (especially his *Historisch-medicinische Bibliographie* . . . *1875-1896*). These are more relevant to other essays in this bibliographic series, however, than to our main concern, which is the profession and art.

Among Sudhoff's successors in medical bibliography, a kind of continuation of the *Mitteilungen* can be seen in the *Index zur Geschichte der Medizin, Naturwissenschaft und Technik* (Walter Artelt, ed., Vol. I, Urban and Schwarzenberg, Munich-Berlin, 1953. 398 pp.), which has a special section for pharmacy. This first volume picks up international bibliographic work with the year 1945 and takes it through 1948. A continuation volume is being prepared.

Walter Artelt, editor of the first volume, has written another book important to anyone interested in writing either medical or pharmaceutical history. His *Einführung in die Medizinhistorik, ihr Wesen, ihre Arbeitsweise und ihre Hilfsmittel* (Ferdinand Enke, Stuttgart, 1949. 240 pp.) has no adequate counter-

part in English. Its bibliographic commentary on bibliographies (about 80 pp.) offers sound guidance and includes much that is pharmaceutical or interlocks with pharmacy. The rest of the book, mainly an excellent discussion of historical methods, also reflects the author's bibliographic grasp of the literature.

Although German bibliographers have been excellent and omnivorous, the serial bibliography probably most useful in pharmacy, which reports new historical publications internationally, is ***Current Work in the History of Medicine*** (Wellcome Historical Medical Library, London, N.W. 1; quarterly since 1954). It covers both new books and journal articles on the history of pharmacy, although not exhaustively. ***Current Work*** is convenient to use and has the virtue of being widely available in pharmacy libraries (selective free distribution). More comprehensive for American pharmacy (and the history of other health professions) is the "Bibliography of the History of Medicine of the United States and Canada" (annually since 1939 in the ***Bulletin of the History of Medicine***). The office of the American Institute of the History of Pharmacy, which contributes the pharmaceutical part, has inaugurated a policy (begun with the bibliography covering 1956) of placing this bibliography in all American colleges of pharmacy.

To cover the thirty-seven years preceding the first annual bibliography in the *Bulletin* (except 1938), we have from Judson B. Gilbert, ***A Bibliography of Articles on the History of American Medicine compiled from 'Writings on American History' 1902-1937*** (No. 9 of History of Medicine Series of the New York Academy of Medicine, New York, 1951. 44 pp.), which is useful, although the coverage of pharmacy is very incomplete. This pharmaceutical gap is partly closed by George Griffenhagen, ***Bibliography of Papers Published by the American Pharmaceutical Association that were presented before the Association's Section on Historical Pharmacy 1904-1957*** (American Institute of the History of Pharmacy, Madison, Wis. [1958]. 26 pp.), which is arranged by years, but has author and subject indexes.

An abstract service on historical publications in pharmacy, arranged by countries, has been edited by Georg E. Dann in its present form since 1952, under the title "Pharmaziegeschichtliche Rundschau" in the ***Pharmazeutische Zeitung*** 88, 235-237 (1952), ***et. seq.***

One of the richest single sources of bibliography on the European profession of pharmacy, although often not yielding quick access, is the quarterly ***Revue d'Histoire de la Pharmacie***, whose Volume I (1930) may be considered a continuation of the ***Bulletin de la Société d'Histoire de la Pharmacie*** (founded 1913). The *Revue* of the French society has been the most important serial exclusively for pharmaceutical history, and for a long time was the only one. The German society likewise has been remarkably productive, but prefers to make its main publishing effort in monograph series that appear at irregular intervals. Anyone just becoming familiar with these publications had best take in hand the guide edited by Herbert Hügel, ***Die Veröffentlichungen der (Internationalen) Gesellschaft für Geschichte der Pharmazie. 1927-1952. Eine Bibliographie*** (Band 7, *Veröffentlichungen* . . . Neue Folge, Eutin, 1955. 40 pp.).

Although the "Critical Bibliography" appearing in the quarterly *Isis* has far more relevance for the science than for the art of pharmacy, it cannot be ignored here. By the end of 1958 eighty-three installments had appeared, a guide for the reader or writer that is quite as important as it is complex. Those not familiar with the systematics might well refer to Henry Guerlac's essay and outline in *Isis*, 44, 226-231 (1953). The "C. B." supplements the monumental

critical bibliography by George Sarton, *Introduction to the History of Science* (Vols. I-III, Washington, D.C., 1927-1948. 839 + 1251 + 2155 pp.), which includes much that is pharmaceutical but does not get beyond the fourteenth century.

Such general bibliographies, in the sweep of centuries and nations, cannot deal comprehensively with unpretentious but often revealing local history. In North America work on local history of pharmacy has been scattered and is not well recorded bibliographically. Encouragement to such work has been given recently by Maurice Bouvet as president of the Union Mondiale des Sociétés d'Histoire Pharmaceutique, who set an example with his *Les Travaux d'histoire locale de la pharmacie en France des origines à ce jour. Répertoire bibliographique* (Société d'Histoire de la Pharmacie, Paris, 1957. 43 pp.), which includes citations to material having international as well as local interest. A comparable work, also arranged by place names, has been initiated for Germany by Helmut Vester, *Topographische Literatursammlung zur Geschichte der deutschen Apotheken. I. Hauptteil 'Deutsche Städte und Ortschaften' A-E* (Band 9, *Veröffentlichungen* . . . Neue Folge, Eutin, 1956. 103 pp.). This first series will proceed to other letters of the alphabet in forthcoming volumes.

General bibliographies, of which selected examples have been mentioned, deal mainly with secondary historical literature within a frame of chronologic, geographic, or topical subdivisions. Beside them stand bibliographic guides to the primary sources themselves, but few available are predominantly pharmaceutical. In one category are the printed library catalogs of books or manuscripts. One of the few pharmaceutical examples in print is by John Uri Lloyd, Theodor Just, and Corinne Miller Simons, "Catalogue of the Pharmacopoeias, Dispensatories, Formularies, and Allied Publications (1493-1957) in Lloyd Library," *Lloydia*, 20, 1-42 (1957). A still more comprehensive type is the annotated, chronologic list of sources going beyond the holdings of a single library. We find especially useful Eugene H. Guitard, *Manuel d'histoire de la littérature pharmaceutique . . . et Biobibliographie pharmaceutique* (Paris, 1942. 138 pp.), which is international before A.D. 1600, then French to 1860. Except for numerous minor changes and additions, the same material may be consulted in Guitard's "Histoire sommaire de la littérature pharmaceutique des origins à 1800," *Revue d'Histoire de la Pharmacie*, 5, No. 26, 185-207; No. 27, 249-263; No. 28, 297-313; No. 29, 374-385 (1935-36); 6, No. 32, 61-72; No. 33, 150-162 (1937-38); and "Bibliographie Pharmaceutique" in the *Revue* . . . , 7, No. 40, 104-124 (1939-40) and No. 41, 171-188 (1939-40). A valuable chronologic catalog of pharmacopeias, formularies, and similar pharmaceutical books is conveniently available in the back of Jean Volckringer, *Evolution et Unification des Formulaires et des Pharmacopeés* (Paris, 1953. 478 pp.). Types of books and geography give a different structuring to the older comprehensive list (fifteenth to nineteenth centuries) by D. A. N. A. Scherer, "Literatura Pharmacopoearum Collecta" in *Codex Medicamentarius Europaeus* (Section VII, Leipzig, 1822. 232 pp.)

Broader in topical coverage, but shorter in time scope (early seventeenth to late eighteenth century) is a bibliography by Ernst G. Baldinger, *Litteratura universa Materiae Medicae, Alimentairiae, Toxicologiae, Pharmaciae, et Therapiae Generalis, Medicae atque Chirurgicae, potissimum Academica* (Marburg, 1793. 359 pp.). A more detailed listing of pharmaco-chemical writings that were published in Germany during the heyday of the pharmacist-chemist there is:

Wilhelm Engelmann, *Bibliotheca Medico-chirurgica et Pharmaceutico-chemica, oder Verzeichniss . . . Bücher, welcher vom Jahre 1750 bis zur Mitte des Jahres 1837 in Deutschland erschienen sind* (5th ed., Leipzig, 1838; chemistry-pharmacy A-Z, pp .495-541). A chronologic list of pharmacy books to 1779 still worth looking into on occasion appears on pages 10 to 29 of Johann F. Gmelin, *Einleitung in die Pharmacie* (Nürnberg, 1781. 392 pp.; a later edition is said to extend the list to 1791).

John E. Waring's *Bibliotheca Therapeutica* . . . and the like come into better focus elsewhere, in connection with materia medica and technical specialties; likewise, the purely medical compilations would carry us too far here. Two notable examples whose usefulness to pharmaceutical writers deserves mention, however, are: *Garrison and Morton's Medical Bibliography* (Leslie T. Morton, ed., 2nd ed., London, 1954. 655 pp.; about 6,500 items, chronologic by topics), and Emerson C. Kelly, *Encyclopedia of Medical Sources* (Williams and Wilkins Co., Baltimore, 1948. 476 pp.; earliest or best article on several thousand medical innovations, by name and subject).

INTERNATIONAL SURVEYS

Akin to the general bibliography with regard to the wide net cast over the literature of pharmacy are the general survey volumes, more or less international and well documented. A selection of these, and varied historical works of a synthetic stamp, will be found listed in George Urdang, "History, Ethics, and Literature of Pharmacy. A Select Bibliography," *Am. J. Pharm. Ed.*, 8, 491-503 (1944), still useful but somewhat dated.

Among comprehensive surveys, the most reliable and useful volume in English is Edward Kremers and George Urdang, *History of Pharmacy* (2nd ed., J. B. Lippincott Co., Philadelphia, 1951. 622 pp.). Consciously written as a combination text and reference book, with heavy stress on the United States, it offers much bibliographic information in the subsections on literature as well as in the chapter bibliographies. Unfortunately, A. C. Wootton, *Chronicles of Pharmacy* (2 vols., London, 1910) provides only very sparse and vague bibliographic information; while in Charles H. LaWall, *Four Thousand Years of Pharmacy* (Philadelphia, 1927. 665 pp.) the chronologic bibliographies seem rather heterogeneous and uncritically selected for use by anyone who does not know the books cited.

Among broad-scale survey volumes in other Western languages, the monumental work by Hermann Schelenz, *Geschichte der Pharmazie* (Berlin, 1904. 935 pp.) stands out. The painstaking documentation, detailed index, and bibliography keep it in use, even though it has been criticized sporadically since publication for inaccuracies and has steadily become less adequate in details, as a further half century of historical investigations uncovers new knowledge.

Still earlier appeared a French work of breadth and serious purpose, but limited bibliographic value, by L. André-Pontier, *Histoire de la pharmacie: origines, moyen age, temps modernes* (Paris, 1900. 729 pp.). Most of the book is devoted to France, but a section on foreign countries (pp. 565-645) includes some not usually discussed in such surveys. Soon came another German survey, a scholarly patchwork by J. Berendes, *Das Apothekenwesen. Seine Entstehung und geschichtliche Entwickelung bis zum XX. Jahrhundert* (Stuttgart, 1907. 366 pp.), which probably was too overshadowed by Schelenz and too narrowly Germanic to stay in the first rank internationally.

Two other examples of broad surveys often referred to are by Giulio Conci, *Pagine di Storia della farmacia* (Milano, 1934. 351 pp.) and Guillermo Folch Jou, *Historia de la Farmacia* (Madrid, 1951. 486 pp.). Among works restricting themselves largely to a single country, two outstanding examples would be A. Adlung and G. Urdang, *Grundriss der Geschichte der deutschen Pharmazie* (Berlin, 1935. 647 pp., with voluminous apparatus and index) and Maurice Bouvet, *Histoire de la pharmacie en France* (Paris, 1937. 445 pp.). A half-forgotten pocket of historical information about American pharmacy perhaps should be mentioned, even though it is devoid of references to sources or further literature: the "Golden Jubilee" issue of *The Druggists Circular*, Vol. 51 (1907), No. 1, 196 pp., a remarkable journalistic coverage of the important half-century preceding.

As a guideline to adjacent literature and general reference work, the most useful one-volume medical history in English remains Fielding H. Garrison, *An Introduction to the History of Medicine*, with medical chronology, suggestions for study and bibliographic data (4th ed., Philadelphia, 1929. 996 pp.; still out of print).

BIOGRAPHY

Alongside general bibliographies stand the biographical reference guides and compilations on the lives of pharmacists who made history. The biographical literature itself does not reach a very high average level, for a type of history reputed to be easiest to write. Much of it is eulogistic in tone, dubiously based in part, and fails to show either the man in his environment, or the place and consequences of his life in relation to his counterparts and his objectives. Much worthwhile biography remains to be written in the history of American pharmacy alone. Some guideposts and pitfalls are pointed out in an essay by George Urdang, "Biographies as Material and as Subject of the History of Pharmacy," *Am. J. Pharm. Ed.*, 7, 326-337 (1943).

Besides necrologies and more meaningful essays to be located through journal indices, cumulative and otherwise, there are rather few guidelines to the life records of eminent American pharmacists. The Kremers and Urdang *History of Pharmacy* (pp. 525-584) includes literature references and brief notes on numerous pharmacists mentioned in the text. "Biographies of American Pharmaceutical Leaders" in *Remington's Practice of Pharmacy* (Eric W. Martin and E. Fullerton Cook, eds., 11th ed., Easton, Penna., 1956, pp. 13-22) gives the *curriculum vitae* of thirty-nine men. *The First Century of the Philadelphia College of Pharmacy, 1821-1921* (Joseph W. England, ed., Philadelphia, 1922. 728 pp., and decennial supplements) is strong in biographical information about persons once associated with the College.

By far the most useful work on European pharmacists, although light on the Anglo-American world, is Fritz Ferchl, *Chemisch-Pharmazeutisches Bio- und Bibliographikon* (Mittenwald, A-L, 1937; M-Z, 1938. 603 pp.), which cites in surprising detail the writings of pharmacist or chemist as well as offering a biographical sketch. It seems little known in this country that some copies are still available.*

A useful older work includes pharmacists who contributed to the literature between 1780 and 1824, although it is now very rare: Adolph C. P. Callisen, *Medicinisches Schriftsteller-Lexicon* . . . (33 vols., Kopenhagen bzw. Altona,

*Listed by Carl-Ernst Kohlhauer, Antiquar, Bergerstr. 87, Frankfurt am Main, at $11 postpaid, for the two-part work.

1830-1845). Two other works, more modest but frequently found in pharmacy libraries, are Josef A. Häfliger's "Biographikon" in A. Tschirch, *Handbuch der Pharmakognosie* (2nd ed., Leipzig, 1932, vol. 1, part 2, pp. 1008-1151), and Burkhard Reber, *Gallerie hervorragender Therapeutiker und Pharmacognosten der Gegenwart* . . . (Geneva, 1897. 45 + 408 pp.). Both have international scope, but the latter is limited to figures prominent in the second half of the nineteenth century.

For particularly eminent scientists coming from pharmacy, we scarcely need be reminded of J. C. Poggendorff, *Biographisch-Literarisches Handwörterbuch zur Geschichte der exacten Wissenschaften* (6 vols., Leipzig or Berlin, 1863-1940 and resuming in 1956 with Part I of Volume 7).

Finally, three volumes of essays about famous pharmacists now in print should be mentioned: *Figures Pharmaceutiques Françaises; Notes Historiques et Portraits 1803-1953* (Paris, 1953. 275 pp. on 38 pharmacists); Otto Zekert, *Berühmte Apotheker* (Stuttgart, 1955. 160 pp. on 67 pharmacists); and Paule Fougére, *Grands Pharmaciens* (Paris, 1956. 336 pp. on 18 French pharmacists; apparently mostly secondary material).

CHRONOLOGIES

Dates provide an orderly framework within which history can be examined; while mind, pen, printer, and false precision or perception all conspire to disorder. The accretion of chronologies is especially subject to this infirmity, and none could be recommended without misgiving.

The universally available chronology that focuses specifically on pharmacy is in the back of Kremers and Urdang, *History of Pharmacy* (2nd ed., 1951, pp. 517-524), which may be misused unless we note the authors' warning that approximate dates "should be obvious" and that "single dates are usually given for individuals." A more detailed chronology, although with Germanic emphasis, is by Herbert Valentin, *Geschichte der Pharmazie und Chemie in Form von Zeittafeln, unter besonderer Berucksichtigung der Verhältnisse in Deutschland* (3rd ed., Stuttgart, 1950. 128 pp.), which has improved accuracy in recent editions. An extensive medical chronology that includes many dates pertinent to pharmacy appears in Garrison, *An Introduction to the History of Medicine* (4th ed., 1929, pp. 809-879). In a different, more meaningful format are the tables by Ludwig Aschoff and Paul Diepgen, *Kurze Übersichtstabelle zur Geschichte der Medizin* (6th ed., Berlin, 1945. 89 pp.). Less known and of particular value for pharmacy is Fr. Berger, "Kurze Notizen zur Geschichte des pharmazeutischen Handwerkzeuges und der pharmazeutischen Gebrauchsegegenstände," *Zentralblatt für Pharmazie,* 25, 169-171 (1929). Meeting more particular scientific interests are two well-known lists: Ludwig Darmstaedter, *Handbuch zur Geschichte der Naturwissenschaften und der Technik* (Berlin, 1908. 1262 pp.; name and subject indexes); and Paul Walden, *Chronologische übersichtstabellen zur Geschichte der Chemie von den ältesten Zeiten bis zur Gegenwart* (Berlin, 1952. 118 pp.). More useful within its narrower range of time and topic is Edmund O. von Lippmann, *Zeittafeln zur Geschichte der organischen Chemie* . . . (Berlin, 1921. 67 pp.).

Bibliographic knowledge of pharmaceutical periodicals has major importance both for locating original sources concerning the profession, in all its branches, and for studying the history of pharmaceutical journalism itself.

SERIALS

Survey volumes usually give some historical data on the journals of one or more than one country. Of historical writings dealing specifically with pharmaceutical periodicals, however, the best and most systematic work is by Eugène Guitard, *Deux Siècles de presse au service de la pharmacie et cinquante ans de 'l'Union Pharmaceutique'* (2nd ed., Paris, 1913. 316 pp.). The eminent French historian of pharmacy here gives us a history and bibliography of pharmaceutical periodicals, considered as one part of a development also seen in related periodicals for the period 1665 to 1860. He stresses the French press without giving up the international scope.

There are also three historical lists of periodicals that supplement each other, and together provide a valuable guide to this part of the library resources. The volume by Henry Carrington Bolton, *A Catalogue of Scientific and Technical Periodicals 1665-1895, together with Chronological Tables and a Library Check-List* (2nd ed., Washington, D.C. 1897. 1247 pp.). Bolton gives 8,603 titles in alphabetic order, with name of editor, bibliographic details, and a subject index. Pharmacy is included, but medicine excluded (except certain medical sciences). It is important to read the preface.

The particular scope of Bolton gives added importance to the superb separate bibliography of medical periodicals by Fielding H. Garrison, "The Medical and Scientific Periodicals of the 17th and 18th Centuries. With a Revised Catalogue and Check-List," *Bulletin of the Institute of the History of Medicine, 2,* 285-343 (1934), which is still available. Garrison distinguishes 107 bibliographic items in the seventeenth century and 1,092 from the period 1701-1800, which include the journals in which pharmacists were publishing and the few then published specifically for pharmacists. It is important to note that additions and corrections have been prepared by David A. Kronick, "The Fielding H. Garrison List of Medical and Scientific Periodicals of the 17th and 18th Centuries; Addenda et Corrigenda," *Bulletin of the History of Medicine, 32,* 456-474 (1958). Both Garrison and Kronick give citations to historical publications on the technical press. Kronick himself wrote *The Origins and Development of the Scientific-Technological Periodical Press, 1665-1790* (unpublished Ph.D. dissertation, University of Chicago, 1956).

The most useful historical list of American pharmaceutical journals, considering the term in a wide sense, was published by Minnie Meyer and Edward Kremers, "The Pharmaceutical Journals of the United States," *Journal of the American Pharmaceutical Association, 22,* 424-429 (1933). It covers the journals published from the beginning (1825) to 1932, the titles being arranged by states in which published, and listed chronologically under each state by dates of founding.

ICONOGRAPHY

The pictorial evidence of pharmacy's past can be enjoyed at surface value, as an embellishment of history; or it can form a special branch of study to find, verify, and interpret historical pictures skillfully. Here we mention a few main repositories and a few printed sources that have used mostly authentic pictures and reproduced them well.

Among collections in the health field, one of the largest is the art section of the National Library of Medicine (portraits alone number about 28,000); the Prints and Photographs Division of the Library of Congress has supplemental

material; and for pharmacy specifically, the American Pharmaceutical Association, the American Institute of the History of Pharmacy, and the Smithsonian Institution (Division of Medical Sciences) are probably the main repositories. The New York Academy of Medicine has an extensive pictorial collection, and one of its staff members, Lola L. Szladits, wrote "Medical Illustrations and Portraits, A Brief Survey of Collections in America," *Eye to Eye* (Bulletin of the Graphic History Society of America), No. 3, pp. 13-22 (1953).

A source of pharmaceutical illustrations, mostly European, that can be recommended with enthusiasm is the German *Illustrierter Apotheker Kalender,* of which Fritz Ferchl edited thirteen volumes during the period 1925-1939; publication resumed in 1955, with Wolfgang-Hagen Hein as editor, and each year there appears a handsome volume of black and white reproductions, adequately identified and explained. A full set, which few libraries possess, reportedly embraces more than a thousand pictures. A welcome essay concerning his work is offered by Editor Hein as "Hinweise zur pharmaziehistorischen Bildinterpretation," *Pharmazeutische Zeitung,* 91-100 [sic], 1416-1419 (1955).

Beginning in 1939 Professor P. van der Wielen of Amsterdam began to edit an annual pharmaceutical calendar, which differs from its German counterpart in the emphasis upon artistic quality and employment of superb full-color reproduction (usually six pictures per year). With the year 1957 the American Institute of the History of Pharmacy began to edit an American edition, using the same plates.

Since the calendars go out of print soon after publication, selected plates have been reprinted under the title *Art and Pharmacy* (2 vols., Deventer, 1950 and 1958, 42 plates each; available in U.S.A. through American Institute of the History of Pharmacy).

A work notable for lavish illustration is Maxime Laignel-Lavastine, *Histoire générale de la médicine, de la pharmacie, de l'art dentaire et de l'art vétérinaire* (3 vols., Michel, Paris, 1936-49), which stresses the French historical scene, but holds interest for all. An Italian work also conveys pictorial history in 800 plates over a wide range of topics, but unfortunately is not so well printed. This book by Carlo Pedrazzini, *La Farmacia Storica ed Artistica Italiana* (Milano, 1934, 592 pp.) unfortunately is already rather rare on the book market. Finally, there should be mentioned a small work valuable for its pictures, by Patrice Boussel, *Histoire illustrée de la pharmacie* (Guy le Prat, Éditeur, Paris, 1949. 195 pp.). The book is well printed, but the enema for females and the public bath do not occupy as large a place in pharmaceutical history as might be inferred.

EQUIPMENT

The equipment used by pharmacists, of a period and place, gives testimony to their type of practice, professional level, and the extent to which technology may have limited historical development or, on the other hand, made possible a new line of advance.

No general history of the pharmacist's apparatus has yet been prepared, nor do I know of a comprehensive bibliography of the monographic work in the literature.

One of the most widely useful publications in this field is by Josef Anton Häfliger, *Pharmazeutische Altertumskunde und die Schweizersche Sammlung für historisches Apothekenwesen an der Universität Basel* (Zürich and Basel, 1931. 203 pp. plus 52 plates). More than a catalog, Häfliger's book provides short

essays and is filled with reliable bibliographic information on equipment, apparatus, shelfware, and almost every kind of artifact that a pharmacy museum might collect.

Useful historical essays, with short bibliographies, on each of ten common pieces of equipment have been issued in pamphlet form: George B. Griffenhagen, *Tools of the Apothecary* (American Pharmaceutical Association, Washington, D.C., 1957. 30 pp.), after appearing serially (*Journal of the American Pharmaceutical Association, Practical Pharmacy Edition,* 17 (1956)).

Commercial catalogs featuring pharmaceutical equipment as well as drug sundries are useful in tracing technologic change. American catalogs issued before 1890 that have been preserved in certain libraries are conveniently listed (though incompletely) in George B. Griffenhagen and Lawrence B. Romaine, "Early U.S. Pharmaceutical Catalogues," *Am. J. Pharm.,* 131, 14-33 (1959).

The best bibliographic guide to historical collections of pharmaceutical equipment appears in George Griffenhagen, *Pharmacy Museums* (American Institute of the History of Pharmacy, Madison, Wis., 1956. 51 pp.; out of print). This not only provides a geographic key to the pharmacy museums of the world, but also to writings about them. Supplementing it with more American detail and literature references is Griffenhagen's *Early American Pharmacies, a Pictorial Catalog of Apothecary Shop Restorations which are on Exhibition in the United States* (American Pharmaceutical Association, Washington, D.C., 1955. 23 pp.; collated from the *Practical Pharmacy Edition, Journal of the American Pharmaceutical Association,* 14 (1953) and 15 (1954)). The collections, with few exceptions, represent the nineteenth century.

The catalogs and other special publications concerning such collections here cannot even be listed. For reference value but also as an example of proper cataloging, there may be mentioned George Urdang, with F. W. Nitardy, *The Squibb Ancient Pharmacy, a Catalogue of the Collection,* New York, 1940. 190 pp.; reserve stock available at Smithsonian Institution, where this famous collection is now housed.

INSTITUTIONS

The social institutions of pharmacy—associational, legal, educational—are by no means fully explored historically, either here or abroad. Monographic work already done can be picked up through general bibliographies, cumulative indices, and chapter bibliographies in survey volumes.

In the history of pharmaceutical education, one of the most useful works of broad scope (although not without flaws) is by Hans Dieckmann, *Geschichte und Probleme der Apothekerausbildung, in erster Linie in Frankreich und Deutschland* (Govi-Verlag, Frankfurt am Main [1953]. 263 pp.). Although basically a comparative study of France and Germany, historical and contemporary, the author also summarizes present conditions of pharmaceutical education in fifty-four countries. For the United States, the richest source of bibliographic information is a two-volume history I wrote some years ago, *American Pharmaceutical Education Before 1900,* which has remained unpublished (Ph.D. dissertation, University of Wisconsin, 1952).

For the American period after 1900, one of the best single sources would be Chapter 15 and its literature references in Kremers and Urdang, *History of Pharmacy* (2nd ed. pp. 280 and 505), supplemented by the thirty-five-page introductory chapter in Lloyd E. Blauch and George L. Webster, *The Pharmaceutical Curriculum* (Washington, D.C., 1952. 257 pp.).

PROFESSIONAL PRACTICE

A bibliographic overview of historical work that has been done on retail pharmacy and conditions of practice seems not readily accessible. Here again the more general bibliographies and surveys give an entering wedge. Much remains to be done here at a high level of social history, although innumerable bricks in the edifice have been put down, very often as reminiscences, histories of individual pharmacies, and the like.

In hospital pharmacy, more work has been done on the history of formularies than on hospital pharmacy as a professional specialty. For the United States, an entry into the literature might well begin with G. F. Niemeyer, Alex Berman and Don E. Francke, "Ten Years of the American Society of Hospital Pharmacists," *Bulletin Amer. Soc. Hosp. Pharm.*, 9, 279-421 (1952) and—mainly for literature published after 1930—Gloria Niemeyer, "Comprehensive Bibliography on Hospital Pharmacy," *Bulletin Amer. Soc. Hosp. Pharm.*, 8, 27-63 (1951) and the biennial supplements (10, 35-55 (1953); 12, 40-61 (1955); and 14, 93-118 (1957)). For a short list of additional references, see Glenn Sonnedecker and Alex Berman, *Some Bibliographic Aids for Historical Writers in Pharmacy* (American Institute of the History of Pharmacy, Madison, Wis., 1958, pp. 10-11).

In pharmaceutical manufacturing many leads to individual articles and books may be extracted from the vast work by Williams Haynes, *American Chemical Industry—A History* (6 vols., D. Van Nostrand Co., New York, 1945-1954). For other useful references, see George Urdang, "Retail Pharmacy as the Nucleus of the Pharmaceutical Industry," in *Essays in the History of Medicine,* Supplement No. 3 to the *Bulletin of the History of Medicine,* Baltimore, 1944, pp. 325-346, and for tracing historical data, recent and also not so recent, consult Walter A. Southern, "Sources of Drug Market Data," *Drug and Cosmetic Industry,* 73, 328-9 and 417-421 (1953). Two valuable works on German industry are the economic history by Wilhelm Vershofen, *Die Anfänge der chemisch-pharmazeutischen Industrie. Eine Wirtschaftshistorische Studie* (v. I, to 1834, Berlin, 1949, 151 pp.; v. II, to 1870, Aulendorf im Württ., 1952, 120 pp.; and v. III, to 1914, Aulendorf, 1958, 155 pp.), and, in part, E. Helbig, *Pharmazie und chemische Grossindustrie, ihre Entwicklung und volkswirtschaftliche Bedeutung* . . . (Tübingen, 1922. 209 pp.). Much work remains to be done on the history of American pharmaceutical manufacturing, although there have been many historical essays on individual companies (usually without bibliographic information). One of the most ambitious series conveniently available is the book by Tom Mahoney, *The Merchants of Life* (Harper & Bros., New York, 1959. 278 pp.).

* * *

The whole structure of pharmacy's history rests upon a knowledge of the literature sources, whether to create history or to broaden understanding by its study. These few guidelines suggest how productive pharmacy has been of a special literature, yet how much remains to be done to find its full meaning in terms of social, scientific, and economic history. A bibliographic essay so selective and general scarcely helps an historian toward filling these gaps, but may help others to find and use intelligently some literature that for them did not exist, and perhaps find an impulse themselves to make a bibliographic or historical contribution.

BIBLIOGRAPHIC MATERIALS IN ENGLISH RELATING TO THE HISTORY OF PHARMACOGNOSY

J. HAMPTON HOCH

The objective of this paper is to call attention to some historical studies on pharmacognosy and to comment about needs for further research in certain areas on the history of pharmacognosy.

Some knowledge of drugs is as old as mankind; therefore the roots of pharmacognosy go back to the beginning of recorded history. Drug study was an ancient study which evolved in all cultures. Biology, medicine, and materia medica have been intimately commingled through the centuries. After pharmacy developed to the point of a specialty, separate from the "regular" practice of medicine, some parts of drug knowledge came to be considered essentially pharmaceutical. Therapeutics, pharmacodynamics, toxicology, posology, bacteriology, medical and pharmaceutical biology (botany and zoology), and pharmacognosy were included in the collective term "materia medica" until recent times.

Since the introduction of the word "pharmacognosy" in 1815, its meaning, "a knowledge of drugs," has been qualified to exclude certain aspects of drug knowledge. However, the science of pharmacognosy developed as a broad field of endeavor embracing many ancillary areas and involving numerous collateral sciences. A modern American conception of pharmacognosy's scope in the pharmacy curriculum is contained in the following statement:

> Pharmacognosy . . . deals with the production, processing, qualities, and general uses of products of biological origin having current medicinal and pharmaceutical importance. It is concerned with their biological history and activity, as well as with problems of collection, processing, and commerce. The subject also embraces the study of constituents, extraction, microscopy, identification, preservation, and protection of these products and their adaptation to pharmaceutical, medicinal, and public health uses . . . . In a broad sense pharmacognosy includes . . . products derivable from the lower forms of life, the microorganisms. Many other materials of plant and animal origin, not used for medicinal purposes . . . have been regarded as within the field of pharmacognosy (1).

The great breadth of pharmacognosy in all its ramifications has been a deterrent to historians who hoped to encompass the whole subject. The only really encyclopedic approach to a history of pharmacognosy is found in Alexander Tschirch's *Handbuch der Pharmakognosie*. This unique accomplishment, which Tschirch refused to entitle a "history of pharmacognosy," is the keystone around which historians of the future will have to build. The "pharmacohistoria," as Tschirch titles his extensive survey, contains what he modestly called "bricks for the foundation of a history of pharmacognosy." This valuable work of a master pharmacognosist is the veritable archive to which historians of pharmacognosy will continue to resort for facts and interpretations. There are few facets of pharmacognosy which Tschirch did not polish brightly.

George Urdang presents some cogent and stimulating comments in "Materials and Outline for a Short History of Pharmacognosy." (2) Recognizing the need for an adequate English language compilation of a history of pharmacognosy, Urdang challenged American pharmacognosists to prepare such a work.

There is no book in English devoted to either a broad or narrow coverage of the history of pharmacognosy; and few articles in the periodical literature go beyond a discussion of limited areas of the subject. Numerous books on the

history of pharmacy, chemistry, botany, and medicine contain a variety of scattered items which are pertinent to the history of pharmacognosy, but such information is of value mostly as background material. The historical introductions found in textbooks of pharmacognosy are, perforce, very brief synopses, scarcely to be considered as contributions to the history of the science.

Bibliographies in books and articles list source materials for the historian. The bibliography of references cited in Alexander Tschirch's *Handbuch der Pharmakognosie* is an extensive compilation of historical sources and the only work which approaches the special bibliographies of historical botany, chemistry, medicine, etc. In English we have a significant contribution to the literature of pharmacognosy in George M. Hocking's compilation of "Periodicals Pertaining to Pharmacognosy. A Preliminary List" (3) which was incorporated into a booklet covering pharmacological serials as well (4).

A bibliographical work of value to the historian of pharmacognosy is George Sarton's *Horus: A Guide to the History of Science* (5). It contains selected bibliographies of many sciences, including chemistry, general biology and natural history, botany and agriculture, pharmacy and toxicology, etc., and it lists source materials which pertain to pharmacognosy. This book is cited in *Some Bibliographic Aids for Historical Writers in Pharmacy,* a fifteen-page pamphlet prepared by Glenn Sonnedecker and Alex Berman, issued in 1958 by the American Institute of History of Pharmacy. Many of the twenty-nine aids recommended for the history of pharmacy and the eleven sources of pharmacobiographical guides are also pertinent to the history of pharmacognosy.

A valuable biobibliographical reference not cited in the Sonnedecker-Berman pamphlet is Lynn Thorndike's *A History of Magic and Experimental Science* (6). The title is somewhat misleading; theoretical science is discussed as much as experimental science. The historian of pharmacognosy will find it worthwhile to consult this work for information relating to the period of the twelfth to seventeenth centuries.

Another elaborate treatise and bibliography which is one of those mentioned in the Sonnedecker-Berman compilation is George Sarton's *Introduction to the History of Science* (7). Much that is significant for pharmacognosy can be culled from this monumental work which, however, extends only to 1400.

In this paper no attempt will be made to provide a complete coverage of the literature relating to the history of pharmacognosy. Tschirch has come close to such a goal for publications up to the earlier years of this century. The more recent, i.e. post-Tschirch, foreign language books and articles will also be omitted, despite the merit and value which many of them have; otherwise this account would become unduly long. Accordingly, the works mentioned will be selected from publications in English not referred to by Tschirch, and attention will be focused on pharmacognosy in the United States.

Accounts in English which are examples of some of the manifold phases of the general history of pharmacognosy are listed below.*

"Contributions of Early Botanists to Pharmaceutical Knowledge" by Charles L. Porter is an interesting article (8). Ernst W. Stieb's "Drug Adulteration and its Detection in the Writings of Theophrastus, Dioscorides and Pliny" clarifies the subject in ancient days (9). "The Romance of Spices" is Charles H. LaWall's story of these aromatic commodities (10).

*The items are not included in Tschirch's *Handbuch* references.

"Garcia da Orta and the First Descriptions of Asiatic Drugs" by Louis H. Roddis (11) presents one of the pioneers of pharmacognosy. S. Prasad has a good bibliography attached to "A Brief Historical Survey of Indian Drugs of Vegetable Origin." (12)

"A Chapter in the History of Pharmacognosy: 16th Century Italy" by J. Hampton Hoch takes us back to the beginning instruction in pharmacognosy (13).

Charles Whitebread discusses "Animal Pharmaceuticals of the Past and Present" (14) but gives no bibliography. The "Outlines for Lectures on Historical Endocrinology" by Arno B. Luckhardt (15) covers an area which has been neglected by historians of pharmacognosy.

Another pioneer in pharmacognosy was the subject of Lyman F. Kebler's paper "Pierre Pomet, a 17th Century Worker for Pure Drugs, Spices, and Foods." (16)

Plant chemistry and biological stains are subjects tangent to pharmacognosy; they are discussed from an historical viewpoint in R. C. Burrell's "Phytochemistry. What it is and How it has Developed" (17) and F. L. Lewis's "Introduction of Biological Stains." (18) These articles are illustrative of the type from which nuggets can be uncovered which contribute to the richness and plenitude of pharmacognosy's history.

L. E. Sayre prepared an article on "The Early History of Biological Products" (19), and H. C. Hamilton included historical information in his "Pharmacological Assaying." (20)

George D. Beal has succinctly presented "The Scientific Development of Drug Standards" (21), and Percival J. Hartley's account of the history of biological standards for drugs is an excellent report on a phase of historical pharmacognosy which has universal significance (22).

A review of the development of quantitative microscopic methods in pharmacognosy was published by J. Hampton Hoch (23).

"British Pharmacognosy" by T. E. Wallis is a review of the growth of pharmacognosy in Great Britain (24). This is one of the few and certainly one of the best articles on its subject. "Pharmacognosy in the Past, Present and Future" by G. Edman (25) is a synoptic view of the science by the Swedish teacher, made available in English through Harald Holck's translation.

One of the very few English language surveys of pharmacognosy's background in the last century is Henry Kraemer's four chapters entitled "Rise and Development of Pharmacognosy" in which he set forth the accomplishments of nineteenth century European leaders (Martius, Flueckiger, Vogl, Tschirch, Meyer, *et al.*) as well as English and American pharmacognosists (26). Emphasis on morphological pharmacognosy was characteristic of the period. Microchemical pharmacognosy, drug standardization methods, and American educational facilities in pharmacognosy were also touched on by Kraemer.

Albert Schneider's *Microanalysis of Powdered Vegetable Drugs* (27) presents a brief summary of American work in microscopic pharmacognosy and an enumeration of some classic German and French works on vegetable drug microscopy.

These two last-mentioned reports lead us to the subject of pharmacognosy's history in America. Latin America is not included in this presentation; most of the significant material pertinent to our Latin neighbors is not in English.

The history of pharmacognosy in the United States needs further research. Books and articles on botanical explorations, on North American Indian drug

lore, and on plant gardens in our country are not lacking, but there is a paucity of historical studies on many other aspects of pharmacognosy.

Folk knowledge of the colonists and frontiersmen and empiric adoption of indigenous plants as drugs is one of the areas requiring further investigation and correlation. The history of work on American drug plants from colonial days into the twentieth century is presented in a series of publications issued as Bulletins of the Lloyd Library of Cincinnati, Ohio (28). These contain a wealth of information about our vegetable materia medica and embody original research by John Uri Lloyd and his brother Charles Gates Lloyd. The recent work by Alex Berman (29) illuminates a period of great activity and interest in botanical medicines. This thorough, commendable historical investigation is an example of the sort of study which unfortunately is too rare. Another contribution falling in this area is that of R. E. Reese and G. E. Osborne "Early Utah Materia Medica: Priddy Meeks." (30)

Medical botany was a field of outstanding importance in the early days of our country. Numerous biographical accounts of the more prominent individuals who are known as medical botanists have been published. Howard A. Kelly prepared synopses of the lives and works of these men (31), and the medical and medico-historical journals carry more extensive accounts of many of them. A brief report on a local medico-botanical situation of the mid-eighteenth century was published by J. Hampton Hoch (32). Few pharmacists or pharmacognosists have attempted historical studies of medical botany in the United States. A notable exception is Alex Berman (33, 29).

Crude drug commerce is also awaiting investigation by historians of American pharmacognosy. Joseph Krafka, Jr. (34) and J. Hampton Hoch (35) have published papers on this phase of pharmacognostic history in the southern colonies in colonial days.

Historical studies on the cultivation of medicinal plants in America have been made by W. O. Richtmann (36) and A. F. Sievers (37). A survey of drug plant breeding was published by W. W. Stockberger in 1914 (38). Other aspects of crude drug production and commerce in our country, *viz.* harvesting, garbling, adulteration, packaging, marketing, have not been the subjects of special historical studies.

Biographies of some prominent nineteenth-century American pharmacognosists—their backgrounds, training, and achievements—have been presented by Henry Kraemer (39) and Heber W. Youngken, Sr. (40). Educators, understandably, are recognized as leaders of the science. Individuals not included in either of these articles have had their biographies prepared by others, and these are found in the journals of the A.Ph.A. and the AACP.

Surveys of pharmaceutical education in the United States pertinent to the history of American pharmacognosy have been written by Glenn Sonnedecker (41) and J. Hampton Hoch (42), and most recently Raymond W. Vanderwyk (43) summarized the content of courses in pharmacognosy.

The Plant Science Seminar is an unique organization which has been a significant factor in the development of American pharmacognosy. Elmer H. Wirth (44) and Edward P. Claus (45, 46) have presented papers containing information on the role and history of this group.

An aspect of American drug standards has been very well presented by Glenn Sonnedecker and George Urdang (47).

The fiftieth anniversary of the Federal Pure Food and Drugs Law of 1906

was commemorated by a series of historical articles in the *Food, Drug and Cosmetic Law Journal* of 1956 (Volume 11).

A compilation of bibliographic material on historical pharmacognosy in the United States is nonexistent as such, but several of the bibliographic works cited by Sonnedecker and Berman (48) contain references which are valuable aids, e.g., the "Bibliography of the History of Medicine of the U.S. and Canada" published annually since 1939 in the *Bulletin of the History of Medicine;* "Catalogue of the Pharmacopoeias, Dispensatories, Formularies and Allied Publications (1493-1957) in the Lloyd Library" which appeared in 1957 in *Lloydia,* Volume 20, and as a separate forty-two-page pamphlet. Another compilation with biographical source material is Mary Jane K. Zachert's "American Contributors to Seventeenth and Eighteenth Century Pharmacy: a Bibliography of Biographical Sources." (49)

Some important source materials for the early history of pharmacognosy have been reproduced in fascimile since the publication of Tschirch's *Handbuch.* Many of these and their locations are listed in Thomas E. Key's *Medical Works in Facsimile, a Bibliography* (50). They range in time from 1700 B.C. to the nineteenth century, and the reproductions often have translations and commentaries by competent scholars.

The existence of numerous secondary materials relating to the primary sources for the history of pharmacognosy up to a few centuries ago stems from the fact that medicine, botany, and chemistry also go back to the same primary sources. Historical studies in these related sciences have been far more assiduous than in pharmacy and pharmacognosy.

The history of pharmacognosy in our country would profit from more detailed and amplified studies on medical botany. New investigation of medicinal plant gardens would contribute to the subject as would studies on crude drug production and commerce from colonial times to the present. The pioneers whose biographies have been presented by Kraemer and Youngken have been succeeded by pharmacognosists whose achievements are an integral part of the history of the science. Changing emphasis in American pharmacognosy awaits adequate exposition of its historical roots.

In the broader universal area of pharmacognosy's history modern studies on the development and application of capillary and adsorption techniques in pharmacognosy, on the development of knowledge about biosynthetic pathways for medicinal substances, and on the growth of information from chemical-taxonomic studies furnish topics for the historian. Pharmacozoology, especially organotherapy and hormones, is a facet which would profit from modern historical study. The story of restrictions placed on poisonous and dangerous drugs is also a phase of pharmacognosy's history which needs investigation.

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(34) Krafka, Joseph Jr., *J. A.Ph.A.*, 28, 616 (1939).
(35) Hoch, J. Hampton, *ibid.*, 27, 712 (1938).
(36) Richtmann, W. O., *ibid.*, 9, 816 (1920).
(37) Sievers, A. F., *ibid.*, 29, 408 (1940).
(38) Stockberger, W. W., *ibid.*, 3, 166 (1914).
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(42) Hoch, J. Hampton, *ibid.*, 12, 148 (1948).
(43) VanderWyk, Raymond W., *ibid.*, 17, 472 (1953).
(44) Wirth, Elmer H., *ibid.*, 9, 229 (1945).
(45) Claus, Edward P., *ibid.*, 12, 165 (1948).
(46) *Ibid.*, 17, 433 (1953).
(47) Sonnedecker, Glenn and George Urdang, *Food, Drug, Cosmetic Law J.*, 8, 741 (1953).
(48) Sonnedecker, Glenn and Alex Berman, "Some Bibliographic Aids for Historical Writers in Pharmacy," American Institute of the History of Pharmacy, Madison, Wis., 1958 (15 mimeographed pages).
(49) Zachert, Jane K., "American Contributors to Seventeenth and Eighteenth Century Pharmacy: A Bibliography of Biographical Sources," Southern College of Pharmacy, Atlanta, Ga., 1956 (14 mimeographed pages).
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Education is a highly selective profession; the fruits of learnedness never are grasped by the masses of the people, but only by the relatively few whose abilities and inner determinations permit them to blend knowledge with understanding and to utilize the product.

Rudolph A. Kuever, Am. J. Pharm. Ed., 7, 46 (1943)

A BIBLIOGRAPHICAL REVIEW OF THE HISTORY OF PHARMACEUTICAL CHEMISTRY

[WITH PARTICULAR REFERENCE TO GERMAN LITERATURE]*

WOLFGANG SCHNEIDER

At a meeting of the German Landesgruppe of the International Society for the History of Pharmacy, which was held in Braunschweig in October, 1958, the author of these lines gave a lecture on "Grenzgebiete zwischen Pharmazie und Chemiegeschichte" (1) (Border areas between the history of pharmacy and the history of chemistry). In the course of the preliminary work, it became apparent how difficult it is to define clearly and simply what fields are covered by "pharmaceutical chemistry" and therefore by its history. The title indicates that this subject is part chemistry, part pharmacy. If pharmacy were a science like chemistry, it would no doubt be easier to define where the field concerned, and therefore its history, begins and ends. However, according to Ernst Urban (2), pharmacy is "supply of medicines" and as such merely bound up with various sciences which include chemistry.

Urban's comprehensive definition of pharmacy as supply of medicines has been simplified by us (3). Modified for the history of pharmacy, it reads: The history of pharmacy embraces the history of pharmaceutical workers, of pharmaceutical activities, and of the results arising from these activities. Pharmaceutical workers embrace all who have been engaged in pharmaceutical activities. Pharmaceutical activities embrace each occupation concerning obtention, identification, examination, preparation, administration, distribution, and distributive organization concerning medicinal substances in all phases.

Therefore the history of pharmaceutical chemistry can be only in part the history of a science; another part must deal with the history of a practical occupation. This is borne out by the fact that chemists regard pharmaceutical chemistry as being on the one hand a part of the actual science of chemistry and, on the other hand, a part of applied chemistry. For the dispensing chemist, however, according to a definition by Ernst Schmidt (4), pharmaceutical chemistry represents that part of dispensing which covers the use of chemistry in the field of pharmacy; it is that part of applied chemistry which meets the scientific requirements of pharmacists and which has to fulfill the manifold needs of the day-to-day work of dispensing.

According to these definitions, the history of pharmaceutical chemistry must be too vast a subject to allow a definition here in all details. Unfortunately, up to the present there is no comprehensive work on this subject. It is therefore necessary either to extract from general works on the history of pharmacy those chapters that cover this field, or else to consult specialized literature in respect to particular problems. It is the purpose of the following to give some indications on this point. Needless to say, the references in the literature quoted cannot cover the entire information available. The selection will be chiefly concerned with literature in the German language and my own works. The author appreciates notification of supplementary information in world literature.

*Translated from the original German manuscript.

If a survey of the historical foundations of pharmaceutical chemistry is required, the student will be well advised, as in all other subjects of pharmaceutical history, to consult *History of Pharmacy* by Edward Kremers and George Urdang (5). Here, in two places, facts belonging to the field of pharmaceutical chemistry are dealt with in detail. First in Part 2 (The Rise of Professional Pharmacy in Europe) Chapter 3 (Medical Theories and Materia Medica), there is a reference to "iatrochemistry" on p. 55 and to "chemotherapy" on p. 59. Furthermore, the summary regarding "materia medica" (pp. 62-67) touches on much that belongs to the development of pharmaceutical chemistry. For this must be said already at this stage: The history of pharmaceutical chemistry is in its essentials identical with the history of those medicinal substances that may be described as chemical. Wherever chemicals make their appearance in the materia medica, there pharmaceutical chemistry begins. Pharmaceutical chemists are primarily those who work with, produce, invent, or are engaged in research work on such chemical drugs. It is therefore a matter of course that in the pursuit of such work many apothecaries have found their way into the history of chemistry. This subject is covered by Part 4 of Kremers-Urdang ("Discoveries, Inventions and Other Contributions to Society by Pharmacists"), Chapter 19 with the subheadings "General Chemistry" (pp. 462-469), "Phytochemistry" (pp. 469-473), "Physiological Chemistry" (pp. 473-475), and "Industry" (pp. 475-480).

In addition to *History of Pharmacy* by Kremers and Urdang which deals primarily with North American conditions but in addition with the most important events in world history of pharmacy, there are a number of other works which make important contributions to the history of pharmaceutical chemistry by dealing with one or another of the more important parts of the subject. "Phytochemistry" which occupies four pages in Kremers and Urdang, figures in the chapters on pharmaco-chemistry of the *Handbuch der Pharmakognosie* by Alexander Tschirch (Vol. 1, Abt. 3, Leipzig, 1933):

Chapter 34: The beginnings of pharmaco-chemistry (Paracelsus; the art of distillation; the pyrochemical method; Via humida—the process of extraction) pp. 1673-1702.

Chapter 42: The further development of pharmaco-chemistry. (From Homberg past Boerhave, F. Hoffmann, Neumann, Marggraf to Scheele; pharmaco-chemical analysis; Hermbstaedt) pp. 1782-1804.

Chapter 44: Pharmacognosia in the nineteenth century. Part I. The development of pharmaco-chemistry in the nineteenth century; from Sertürner to the present. pp. 1808-1817.

All these chapters contain references to medicinal preparations derived from drugs by chemical means, the producers of which were frequently apothecaries. Accordingly, these sections of the Handbuch by Tschirch, which go into considerable detail, represent quite a major part of the history of pharmaceutical chemistry.

In this connection, it must be pointed out that the usage of the word "drug" is different in the German and the Anglo-Saxon languages. Whereas in certain countries, drug is sometimes taken to mean medicinal preparations or medicinal specialties, the original sense still prevails in Germany. The Deutsche Sprachverein has made the following statements (6):

1. To trace the word to the Persian—Arabic is erroneous.

2. The word "Droge" (drug), as drogue, appears in French in the fourteenth century, when it was used to describe various kinds of spices. It is not however of French origin but represents a new-German re-adaptation from the Romance languages;
3. The German (West-Germanic) origin of the word is represented by the Old High German trucchan, Old Saxon drokno or drukno, Middle Low German droge or druge, Dutch droog and Dröge, Anglo-Saxon dryge (modern English dry), North Frisian dragg; all of these have the meaning dry, dried, dessicated or cured, juiceless, withered, solid, firm, consequently the equipment for drying (Dare) was also described as drögerei, drogerei.

In Germany, then, the word "drug" refers only to the raw materials of vegetable or animal, previously also of mineral origin, used in the production of medicines.

Tschirch's chapter on pharmaco-chemistry and that on phytochemistry by Kremers and Urdang do not have the same contents; the first term is far more comprehensive than the second—as the chemistry of vegetable drugs, which is covered by phytochemistry, forms only part of pharmaco-chemistry which in addition to the chemistry of vegetable drugs, also covers that of animal and mineral drugs. These last, as such, no longer play a very important part in present-day medicine and pharmacy; hence, contrary to ancient pharmacognosia, they have ceased to be part of this science. At the same time they are still of pharmaceutic importance as the production of pharmaceutical chemicals is derived from them. For information on them and their history, it will therefore be necessary to consult works on inorganic chemistry.

The great work, *Gmelins Handbuch der anorganischen Chemie* (Handbook of Inorganic Chemistry) (7), contains, in its eighth edition (still in the process of publication) the entire literature on this subject, including history, up to the end of the year 1949. A number of excellent monographs on the history of various elements is already available:

Vol. 3. Oxygen (Issue 1, pp. 1-82, 1943, reprint 1953);
Vol. 4. Nitrogen (Issue 1, pp. 1-2, 1934, reprint 1955);
Vol. 8. Iodine (Issue 1, pp. 1-2, 1931);
Vol. 9. Sulphur (Issue 1, pp. 1-60, 1942, reprint 1952);
Vol. 18. Antimony (pp. 1-48, 1942; reprint 1952 and 1953);
Vol. 27. Magnesium (pp. 1-3, 1937, reprint 1953);
Vol. 28. Calcium (pp. 1-68, 1950);
Vol. 35. Aluminium (pp. 1-3, 1934-1935);
Vol. 59. Iron (pp. 1-59, 1929, reprint 1955). This part, dealing with history, consists solely of references in literature.
Vol. 60. Copper (pp. 1-34, 1955);
Vol. 62. Gold (pp. 1-100, 1950);

The other parts available on history (Vol. 10: Selenium; Vol. 38: Thallium; Vol. 39: Rare Earths; Vol. 58: Cobalt; Vol. 68. Platinum) are of lesser importance with regard to pharmaceutical chemistry than those listed above of which, for instance, the story of antimony in the seventeenth century can be directly absorbed into a history of medicaments.

The work on organic chemistry corresponding to the *Handbuch der anorganischen Chemie* is "Beilstein," on the history of which Friedrich Richter has

compiled a survey well worth reading (8). It contains no chapter on history like the "Gmelin," but indicates where the production of a combination is described for the first time. In view of the present-day importance of synthetic drug chemistry, which in these instances is at the same time pharmaceutical chemistry, it should be obvious that this work is likewise indispensable for particular problems, even if it does not contain an account of the history of organic chemistry. On this subject there is the book by Carl Graebe, *Geschichte der organischen Chemie* (History of Organic Chemistry), Vol. I (Berlin, 1920), and as an augmentation *Geschichte der organischen Chemie seit 1880* (Berlin, 1941) by Paul Walden.

For current information on the newer contributions on the history of chemistry, the *Chemisches Zentralblatt* (9) publishes a list of references under a special heading. This reference publication is available in most of the larger libraries of chemical and related institutes.

These bibliographical notes would not be complete without reference to a biographical work. The historian of a science is generally interested not only in a fact but also the man who has brought it to light. For purposes of pharmaceutical history it is, therefore, of importance to know the *Biographisch literarisches Handwörterbuch zur Geschichte der exacten Wissenschaften* by Johann Christian Poggendorff (Biographical-Literary Manual on the History of the Exact Sciences). Since its first edition in 1863, it has been published in a number of supplementary volumes the latest of which is in the process of publication (10). *Einführung in die Medizinhistorik* (Introduction to the History of Medicine) by Walter Artelt (Stuttgart, 1949) is another work which cites possible sources of further information on the history of pharmaceutical chemistry; at the same time it is thoroughly recommended as an introduction to the methodology of pharmaceutical history on a scientific basis.

The information obtainable from the above-mentioned works presents many aspects of the picture but is still not adequate since in all cases the history of pharmaceutical chemistry is merely being included and does not form the central theme. What is still lacking is a chronological survey indicating the periods of development from the earliest beginnings up to the present. It is certainly still too soon to draft such a work that requires the thorough investigation of the various eras, which has so far been only partially carried out. Nevertheless, certain points are already apparent, and mention will be made of the most important relevant literature.

On the history of chemistry, a shorter, reasonably priced work by Georg Lockemann in the Göschen Collection (11) is available in the German language; this contains, at the beginning, a "Zeitalter der Alchemie" (Age of Alchemy). This, too, will have to be considered in a history of pharmaceutical chemistry since many achievements of this early period of science have benefited pharmacy. After all, the age of alchemy saw the discovery of sulphuric acid and nitric acid which were later themselves used in medicine, and furthermore became important in the manufacture of medicinal preparations. Another factor to be borne in mind is the development of chemical apparatus (12); this was taken over by the apothecary's laboratory, especially from the time distillation played an important part in the production of medicaments. R. J. Forbes has written a *Short History of the Art of Distillation* (13). This book, following an introduction, contains chapters on The Alexandrian Chemists, The Arabs, The Middle Ages, From Brunschwyck to Boyle, From Boyle to Lavoisier, The Wedding

of Spirit and Science, New Vessels for Old, and The Aftermath; the bibliography contains 673 citations. In this connection, mention should be made of the work of Friedrich Dobler, *Conrad Gessner als Pharmazeut* (Zurich, 1955) which describes the enacting of ancient distillation processes with modern laboratory equipment. Another reason why we speak of an alchemical period in the history of pharmaceutical chemistry is the relationship between the basic theoretical conceptions of alchemy and pharmacy. The mediaeval alchemists of the Occident were searching for the Philosophers' Stone not only to gain gold and silver by the transmutation of base metals; they also wanted to create a Universal Remedy. Karl Christoph Schmieder, who himself still believed in the realization of alchemical aims, writes in his *Geschichte der Alchemie* (14) (History of Alchemy) as follows:

> The same preparation of the Art that tinges gold is before its entire completion one of the most beneficial physics, a panacea of life.
>
> The use of it, however, demands the greatest care as too much of it will destroy. Only in solution, as drinkable gold (aurum potabile) and in homoeopathic dilution, it may be used now and again. It rejuvenates old age and strengthens the spirit, it brings back lost procreant powers; used wisely, it will prolong human life well past the normal span.
>
> Providing the organism has not been destroyed, it can cure many diseases by forcibly driving out the matter of the disease by the sweat without that this weakens the body because the power of the elixir achieves in hours or days at most what with the use of other medicines is accomplished only by frequently repeated efforts of nature.

It appears that the early alchemists of the Hellenistic stamp did not yet pursue this aim. For them, the meaning of chemistry was probably the equivalent of "Metal casting" or "working with castable materials," derived from metallurgy which in due course led to the making of gold. It was not until the later Islamic alchemists that there was the additional quest for a universal remedy, and it may be that these influences came from the Far East, possibly China. I have collected these various views in a report entitled "Über den Ursprung des Wortes Chemie" (Reflections on the Origin of the Word Chemistry) which will appear in the periodical *Pharmazeutische Industrie* (15) in January, 1959. The following references in literature will be quoted:

J. Ruska, *Neue Beiträge zur Geschichte der Chemie.* I. Die Namen der Goldmacherkunst. Quellen und Studien zur Gesch. d. Natw. u.d. Med., Bd. 8 (Schluss) Heft 3, pp. 1-31, Berlin (1942). (New Contributions to the History of Chemistry. I. The Names of the Art of Gold-Making. Sources and Essays Concerning the History of Natural Science and Medicine).

E. O. v. Lippmann, *Entstehung und Ausbreitung der Alchemie.* Bd. 3, Weinheim (1954) pp. 18-21. (Beginning and Growth of Alchemy.)

F. Sherwood Taylor, *The Alchemists,* London (1953) pp. 68-75.

E. J. Holmyard, *Alchemy,* Pelican Book A. 348 (Penguin Books) Harmondsworth, Middlesex (1957).

S. Mahdihassan, The Chinese origin of three cognate words, Chemistry, Elixir and Genii. *J. Univ. Bombay* 20: 107 (1951). The Chinese origin of the words, Kimia, Sufi, Deverish and Qalandar, in the light of mysticism. *J. Univ. Bombay* 25: 124-151 (1956). Alchemy and its connection with astrology, pharmacy, magic and metallurgy, *Janus* 46, 81-193 (1957).

According to the usual order of chemical history, the age of alchemy is followed by the "age of iatrochemistry" which, for reasons stated hereunder, we prefer to call the "age of Chemiatry." The change from alchemy to "chemiatry" is marked by the activity of the great physician Theophrastus Bombast of Hohenheim, called Paracelsus.

The authoritative edition of his works is that carried out by Karl Sudhoff (16). This is being continued since, besides Paracelsus' works on medicine and the natural sciences, which have been available for some time, the theological writings of Paracelsus remain, for the most part, still in the form of handwritten manuscripts, buried in libraries. This edition is in the hands of Kurt Goldammer (17).

As regards Paracelsus, the following problems are of particular interest for the history of pharmaceutical chemistry: Which medicinal preparations were introduced into the pharmacopeias by Paracelsus, and what "chemical" theories were responsible?

On the subject of these theories, an ambitious work has just been published by Walter Pagel. His book, *Paracelsus, An Introduction to Philosophical Medicine in the Era of the Renaissance* (18) is comprised of the following: The Life of Paracelsus, The Philosophy of Paracelsus, Medicine, The Sources of Paracelsus (Ancient-Mediaeval-Contemporary). Of particular interest on the subject of pharmaceutical chemistry are, regarding "philosophy," his teachings of the elements with the three principles sulphur, sal, and mercurius; regarding "medicine," the chemical evaluation of the salts, and the theory of symbols; in the "sources" are references to Raymundus Lullus, Arnaldus de Villanova, and to alchemy (which Paracelsus, it will be remembered, directed along the lines which made it one of the pillars of medicine, as the means of obtaining medicinal substances).

The research work carried out on Paracelsus has not yet progressed far enough for opinions to agree on the importance of this chemist-physician. Consequently, the comments given hereunder are still considerably colored by personal views. We are of the opinion that he represents the beginning of a new era in pharmaceutical chemistry; we regard his work as having been of superlative importance in our field.

A good deal may be said against this. A scientist who collaborated in the edition of a very beautiful and admirable collection of the works of Georg Agricola (19) wrote to me, for instance, to the effect that he regarded the book *De natura fossilium libri X* by Agricola, with its scientifically exact details of medicinally usable minerals, as more valuable than the frequently obscure, cumbersome, or even unintelligible accounts of Paracelsus. This may be answered by the argument that Agricola has no doubt done more for the development of mineralogy, in particular pharmaceutical mineralogy, than Paracelsus. The pharmaceutical-chemical products, however, that Agricola described and explained, had been handed on from antiquity and not infrequently became obsolete in medicinal usage in the course of time after Agricola. This was due to the fact that they were replaced by the preparations of Paracelsus and his disciples, which would appear to indicate that within the framework of the history of medicinal substances, Paracelsus must be rated the more important. The question now is, were these new preparations actually of Paracelsus' own invention? This cannot yet be decided with certainty. There can be no doubt that long before Paracelsus, chemical preparations—perhaps the very ones he used—were

recommended for the treatment of disease. These did not, however, have any impact on the traditional store of medicines and remained isolated instances or in literature. It was only when these were taken up by Paracelsus (if we really do not want to speak of his inventions) that they found their place in general therapeutics and the official pharmacopeias.

We have begun to investigate these matters more closely. We have examined pharmacopeias (in the sense of officially published books on drugs) and the duties paid on medicines ("Arzneitaxen") in the sixteenth and seventeenth century; and we have found that, approximately at the time of the turn between these two centuries, there was a marked change in medicinal usage. Chemical preparations made their appearance which were to remain in use for nearly two centuries. The publications listed hereunder report on the partially novel methods by which we conducted our investigations:

Wolfgang Schneider, "Methodisches zur Arzneimittelgeschichte," in *Die Vorträge der Hauptversammlung der Internationalen Gesellschaft für Geschichte der Pharmazie* . . . in Heidelberg, Stuttgart, 1958, pp. 167-176. (Research methods regarding history of medicinal substances, publ. in "lectures at the main meeting of the Int. Soc. for Hist. of Pharmacy.")

Ditto, "Untersuchungen über den Arzneischatz der Vergangenheit" (Investigations into the Drug Resources of the Past) "1. Mitteilung Grundsaetze für eine historische Statistik" (Fundamentals for Historical Statistics) *Arz. Forsch.* 7, 380-386 (1957).

Of the above-mentioned medicinal substances which first appeared in the seventeenth century, the following are probably connected with Paracelsus (compare Gerald Schröder, "Die pharmazeutisch-chemischen Produkte deutscher Apotheken im Zeitalter der Chemiatrie" (The Pharmaceutical-chemical Products of German Apothecaries in the Age of "Chemiatry) (Vol. 1 *Veröffentlichungen aus dem Pharmazie-geschichtlichen-Seminar der Technischen-Hochschule Braunschweig,* Bremen, 1957)):

Colcothar (iron-III-oxide with changing contents of iron-III-sulphate)
Spiritus salis (dilute hydrochloric acid)
Sal vitrioli vomitativus (sulphate of divalent metals, usually of copper, iron or zinc)
Vitriolum veneris (copper sulphate or copper acetate)
Spiritus tartari (greatly diluted acetic acid with low-content pyrotartaric acid)
Salia herbarum (impure potassium carbonate)
Oleum antimonii (antimony trichloride)
Mercurius vitae (antimony oxychloride with antimony-III-oxide)
Crocus metallorum (antimony-III-oxide, potassium antimonate and potassium thioantimonate)

Other preparations were traced back to authors who may be described as disciples of Paracelsus:

Thurneysser	Sal jovis (tin-II-acetate)
Beguin	Mercurius praecipitatus (mercury-I-chloride)
	Cinnabaris Antimonii (mercury-II-sulphide)
Croll/Beguin	Turpethum minerale (basic mercury-II-sulphate)
	Cohob Antimonii (dilute hydrochloric acid with traces of mercury and antimony salt)

Croll	Tartarus vitriolatus (potassium sulphate)
	Vitriolum martis (iron-II-sulphate)
Mynsicht	Spiritus salis coagulatus (potassium chloride)
Quercetanus	Mercurius dulcis (mercury-I-chloride)
	Cremor tartari (potassium hydrogen tartrate)
Hartmann	Spiritus salis armoniacus (solution of ammonia and ammonium carbonate)
Suchten	Bezoardicum minerale (antimony-III-V-oxide)
"Basilius Valentinus"	Aurum fulminans (gold-ammonia complex compound)
	Antimonium diaphoreticum (mixture of antimony acid, its potassium salt and potassium sulphate)

The listing of these originators must be subject to a proviso as the literature of the sixteenth century and before this time has not yet been sufficiently explored from a pharmaceutic-chemical point of view to allow definite statements. The above information is given in accordance with our present state of knowledge; it remains our endeavor to improve upon this to enable us to confirm or amend our views.

The expositions of Paracelsus open up that age in the development of pharmaceutical chemistry that we describe as "chemiatry." This, like the word formation "iatrochemistry," indicates "medical chemistry" (from iatros= physician). We suggest that "iatrochemistry" be used only in the sense customary in the history of medicine, with Franz de la Boe Sylvius as representative. In respect to "chemiatry," however, we propose the following (20):

We define "chemiatry" in the history of medicinal preparations as the art of application and preparation of medico-chemical substances introduced by or developed from the basic principles of Paracelsus. As characteristic of "chemiatry" we regard:

1. Choice of remedy on the basis of the interpretation of the course of the disease from the Paracelsan-chemical point of view.
2. Preparation of medicines according to alchemical working processes.

Where the spiritual legacy of Paracelsus was not yet or no longer involved, we cannot speak of an actual "chemiatry." Medicinal history defines these periods as "pre-chemiatric" or "post-chemiatric."

This definition lays no claim to being sacrosanct. It is merely a question of a working hypothesis which will have to be tested further in the light of new examinations. So much, however, is already obvious: the "chemiatric" period of medicinal history is demonstrated from *ca.* 1600 onwards by the stocks in the pharmacies; we have, for the present, established this for Germany but assume that similar conditions applied in other European countries. Investigations to confirm this are still to be carried out. It is also certain that the "chemiatric" pharmacopeia was not subjected to any material change until around 1800. There were a few isolated instances of new remedies being introduced, but these can hardly be regarded as epoch-making in the evolution of pharmaceutical chemistry. Such a change was reserved for the nineteenth century which marks the beginning of a new era.

The time around 1800—a few decades either way—was the period of the great pharmacists who were successful in the field of chemistry. Reading matter on the subject includes *Figures Pharmaceutiques Francaises* (21); *Berühmte Apotheker* (Famous Apothecaries) by Otto Zekert (22), and his monographs

on Carl Wilhelm Scheele; also the book by George Urdang *The Apothecary Chemist: Carl Wilhelm Scheele* (23); on Martin Heinrich Klaproth, whose biography written by George Dann has just been published in book form (24); on Joseph Louis Proust, Sigismund Friedrich Hermbstaedt, Louis-Nicolas Vauquelin, Joseph Pelletier, the Berlin apothecary family Rose, Pierre Jean Robiquet, Johann Wolfgang Döbereiner, Friedrich Wilhelm Sertürner, Philipp Lorenz Geiger, and many others. All these played a part in the quick development of the chemical science which, since the activity of Lavoisier and favored by the general cultural development, entered a state of unprecedented progress. Frequently their work was directed along pharmaceutical lines but one of them alone was responsible for the decisive progress of pharmaceutical chemistry: Friedrich Wilhelm Sertürner (25). The problem he worked on, namely the isolation of the effective substances from vegetable drugs, led him into the realm of organic chemistry, the advance of which during the nineteenth century had a profound influence on the development of the dispensary.

It will be remembered that the pharmacist Sertürner discovered the morphia in opium, and it was he who coined its name. The date of this discovery has been the subject of much discussion. This is shown, for instance, in the detailed work by Hermann Cönen *Uber das Jahr der Morphiumentdeckung Sertürners in Paderborn* (The Year Sertürner Discovered Morphia at Paderborn) (26); the views of Günther Kerstein on this subject are of even greater importance (27). In conclusion, one would probably be justified in saying: Sertürner published his important paper in 1806 (28); in it he describes experiments of earlier years and these were certainly not carried out prior to 1804.

This first publication was ignored by the world of science. Only the proofs which Sertürner demonstrated in his work of 1817 (29) met with the notice they deserved. Of greater consequence than the discovery of morphia was the simultaneous recognition by Sertürner that in respect of this natural substance, he was dealing with an organic base. This was something completely new in chemistry as it had been assumed that bases existed only in inorganic compounds. This new knowledge pointed the way for the isolation of corresponding natural substances from other medicinal plants. "Die ersten Anfänge der Alkaloidchemie" (The Earliest Beginnings of Alkaloidal Chemistry) were described by me in *Archiv der Pharmazie* 1956 (30). One discovery followed another in rapid succession, and practical application did not lag behind. This was to have the most far-reaching consequences for the profession of apothecaries and chemists.

Until then, the development of pharmaceutical chemistry had been most intimately bound up with the history of the apothecary-chemist since it was in the pharmacy with its laboratory that most of the chemical preparations used in medicine were produced. The basic materials required, such as minerals, metals, or other technical chemicals, were supplied by wholesalers. Gradually, the latter were joined by the pharmaceutical manufacturers, the rise of which is an important chapter in the newer history of pharmaceutical chemistry.

On the history of the chemico-pharmaceutical industry, with special reference to German conditions, there is a three-volume work by Wilhelm Vershofen (31); I have given a summary of the contents in the periodical *Pharmazeutische Industrie* (32). Vershofen orders the development as follows:

The first period of the early chemico-pharmaceutical industry lasts until 1814, the second until 1834, the third until 1870. Then follow three periods of the actual chemico-pharmaceutical industry, from 1870 to 1874, 1874-1894, 1894 until 1914. The work ends with the beginning of World War I.

The oldest concerns in the pharmaceutical-chemical industry were developed either from pharmacies or chemists' shops. Examples are supplied in detail by the stories of individual firms, e.g., that of Fa. E. Merck, Darmstadt, which was built up from the local Engelapotheke; in the handsome volume *Heinrich Emanuel Merck* by Carl Löw (33); or that of Fa. Schering which has its origin in the Grüne Apotheke at Berlin; in Hans Holländer's book *Geschichte der Schering Aktiengesellschaft* (34) (History of the Schering AG). As an example of the founding of a drug wholesale concern, we would mention the recently published work by Alfred Bürgin *Geschichte des Geigy-Unternehmens von 1758-1939* (35) (History of the Geigy Concern).

The connection between the discoveries of Sertürner and the modern development of pharmaceutical chemistry is particularly obvious if one remembers that it was just the alkaloids which were being produced as new chemical medicinal substances in specialized factories. According to our, so far unpublished, investigations, these preparations appeared in the German pharmacopeias from 1827 onwards (*4th Preussische Pharmacopöe*); soon the apothecaries left their production entirely to the factories, which at the same time began to produce, in ever increasing quantities, preparations that had hitherto been made solely in the pharmacy. Soon, however, the possibilities of manufacture developed in quite new directions. Pharmaceutical chemists were synthetizing organic substances, e.g., chloral hydrate, salicylic acid, antipyrin, phenacetin, veronal, salvarsan, etc. The immense development from about 1900 has been described by Carl Ludwig Lautenschläger in his book *50 Jahre Arzneimittelforschung* (36) (50 years of Medicinal Research).

This development of the pharmaceutical industry effected a fundamental change in the function of the pharmacy. Today, only few chemical preparations are made up in the dispensary. Instead industrial products are sold, for the pharmaceutical industry has taken over not only the production but also the fabrication. The rise in specialization was particularly assisted by conditions in the U.S.A. where numerous important firms of this kind came into existence even in the nineteenth century.

The great advances in modern pharmaceutical chemistry were achieved in the laboratories of universities and of industry. Pharmaceutical research and retail pharmacist-chemists have long ceased to be identical; specialization, a general trend of our age, has led to this division. It should not, however, be forgotten that the pharmacists' calling is the older, and that pharmaceutical chemistry has received its greatest stimulation from pharmacy of old. The dispensing pharmacist, even if he is no longer the producer of pharmaceutical chemicals, remains a scientific expert in this field. It is his important task that, in addition to the demands of his practical work, he is a reliable consultant of physicians on all questions of pharmaceutical chemistry.

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. . . it is unfortunate that in both . . . groups—the highly intelligent as well as the average—there are those who are not willing to expend the effort necessary to turn natural ability into real success.

Rudolph A. Kuever, Am. J. Pharm. Ed., 7, 47 (1943)

ARTICLES

THE STATUS OF PHARMACOLOGY AS A SCIENCE*

CHAUNCEY D. LEAKE

In the current explosion of pharmacological interest and experimentation, it might be wise to take stock, to pause for a bit and consider just what pharmacology is about. What is the status of pharmacology as a science? What are its peculiar and characteristic features that distinguish it from other sciences? What is the extent of application of pharmacological knowledge? What are the theoretical concepts on which pharmacology rests?

Let it be clear at once that no intellectual discipline reaches the status of a science until its basic concepts are examined and established and until its theoretical foundations are at least explored. Most people who are concerned with pharmacology are interested in it as a practical matter by which new drugs may be developed, some of which may be extremely important, saving many lives, promoting much health, and incidentally bringing in a lot of money to those who are concerned in the development and use of these drugs.

It would be wise for all who are interested in pharmacology to consider the theory on which it may prosper. The importance of theoretical concepts in science may readily be appreciated when one considers the significance of theoretical physics. It was pure theory which led to the many dilemmas confronting us in regard to nuclear power. It has been mathematical, physical, and chemical theory which has made so much of our current comfort and civilized convenience possible.

Americans generally have been reluctant to undertake theoretical studies. However, if we are to maintain leadership in the application of science, we must ever furnish the essential nourishment on which practical applications flourish. The chief food for our very practical culture is scientific theory. It might help to give some attention to the theoretical background of pharmacology.

WHAT IS PHARMACOLOGY?

Pharmacology is a remarkable scientific discipline. It brings together all the complex theories and confirmable data acquired in the expanding disciplines of chemistry and biology. Pharmacology is the study of the action of chemical agents on living material, whether plant or animal, or whether the action is beneficial or harmful. The chemical agents in turn may be mixtures, such as occur in crude drugs of various sorts, or they may be specific elements or compounds. As a science, pharmacology rose in the nineteenth century in association with other aspects of functional biology, such as physiology, biochemistry, and pathology.

Here it might be wise to keep in mind an important concept on nineteenth century biological advance, which frequently has been forgotten. The great biological generalization given by Charles Darwin (1809-1882), in the principle which was first announced a century ago, profoundly influenced all thinking.

*This article was written at the invitation of the Editor.

The cell theory, elaborated by Theodor Schwann (1810-1882), had vastly extended our concepts of living material. Rudolf Virchow (1821-1902) immediately grasped the importance of considering living material from cells to societies. His great concept of disease, while chiefly elaborated with respect to cells, encompassed the range of living material from cells to societies.

It was in this atmosphere of significant biological advance that pharmacology arose. Its background of empirical observation, which existed from antiquity, focused attention on the immediate practical consequences of studying the action of chemicals on man. The active chemicals of anciently used crude drugs were beginning to be isolated, and their practical importance in the management of disease made systematic scientific progress subservient to the practical business of finding better drugs than those that existed in nature.

Pharmacology grew rapidly by the extension of a vast number of empirical observations, as obtained from animal experimentation and from clinical study. This was gradually extended to the analyses of activity, but it was not until the beginning of this century that sufficient advance had been made to undertake systematic screening of various related chemicals in order to choose the one that might be best for the purpose desired. Significant theoretical concepts for pharmacology did not begin to arise until the last few decades.

THE SCOPE OF PHARMACOLOGY

The specific intellectual problems which define the scope of pharmacology as a science, differentiating it from other sciences, are chemical and biological in nature. There are five such specific problems: (1) dose-effect and time-concentration relations; (2) localization of the biological site of action of chemicals; (3) mechanisms of absorption, distribution, fate and metabolism, and excretion of chemicals in living material; (4) the mechanism of actions of chemicals on living material; and (5) the relations between chemical constitution and structure and biological action. These deserve more extended consideration.

While the specific intellectual problems defining the scope of pharmacology as a science are rather sharply delineated, the scope of pharmacology as a discipline goes beyond its scope as a science. This is because the concept of pharmacology, embracing both chemistry and biology, may be applied in so many different practical ways.

Pharmacology, of course, developed in a practical way in association with the medical profession. Gradually it has extended to the other health professions, as these have grown. From the earliest times, pharmacology as a scientific discipline was associated with pharmacy. Pharmacy, however, is a professional art, and uses the scientific information derived from pharmacological studies for the successful and satisfying development of drugs for various uses. Pharmacology and pharmacy have always been closely associated.

Nevertheless, the major applications of pharmacology have been in the practice of medicine. Here drugs have been developed for use in the diagnosis of disease, in the prevention of disease, in the "cure" of disease, and in the alleviation of the symptoms of disease.

Similarly, pharmacology has been applied successfully in the practice of dentistry, and also more recently in the practice of nursing. Pharmacology is now also widely being developed in veterinary medicine, and it is also being widely applied in public health. Pharmacological knowledge can also be used by other members of the growing health team, as by laboratory and radiation technologists, by physical therapists, by clinical psychologists, and even by social workers. For

example, the habitual use of drugs by certain individuals may be of great importance in the social consideration given in the promotion of health or in the management of disease.

More extensively the precise scientific knowledge derived from pharmacology is finding growing application in agriculture in ripening of fruits, in the control of growth, and even in forestry. It is being applied widely in pest control, and there is a fascinating field of pharmacological application in chemical warfare. Pharmacological knowledge is also applied in sociology, and in criminology, especially in connection with the use of addiction drugs, and thus pharmacology finds application in law.

It is thus apparent that the scope of pharmacology is extremely broad, and that pharmacology has grown increasingly significant, particularly in its applications to the health professions and even to engineering problems that involve water supplies, agriculture control, and pest control.

DOSE-EFFECT RELATIONS

Dose-effect and time-concentration relations have been implicit from antiquity. The oldest document incorporating drug use which we know about was the Ebers Medical Papyrus, which we destroyed by bombing in Leipzig. This had been found in the middle of the nineteenth centry, and it has been carefully translated and annotated. It is a "cookbook" type of formulary, listing some 800 prescriptions for various diseases. It is not well organized by our standards, but at least the beginning of an organization can be followed. Many crude drugs are recommended for various types of diseases, and usually in a fairly sensible manner, resulting from observing and recording the effects of such materials which might have been tried for food or which might have accidentally come into contact with the skin. Very significantly a large proportion of the prescriptions for administration internally are measured. There was the ancient realization that there is a relationship between the dose of a drug and the effect that it may produce. Importantly, no toxic doses are recommended. The Ebers Papyrus was written about 1800 B.C., but probably was copied from earlier sources.

Nearly two millenia later Dioscorides, the Greek surgeon in the armies of Nero, wrote his famed *Materia Medica,* albeit in Greek. This was a classification of crude drugs used from antiquity and was an organized attempt to discuss the merits of individual drugs, without relation to the formularies or the prescriptions in which they might be used. Each drug was described from the standpoint of names, place or origin, method of identification, characteristics, actions, uses, and dosage. This provided the key to the later development of pharmacopeias.

Even through the long transmission of early Egyptian drug lore, through the Greek and Roman period, the medieval codifications and the Renaissance, there continued to be an appreciation of dose-effect relations. In general, physicians realized that the common folk belief "that if a little bit of a drug is good for something, a little bit more will be better" is entirely misleading. The little bit more may be very dangerous.

Even the Greek physicians of the Hippocratic School at Cos realized the two factors that may cloud a physician's judgment regarding drugs. The first is the realization that some people tend to get well regardless of what may be done for them. This principle of the "healing power of nature" was embodied in a later Latin phrase, *"vix medicatrix naturae."*

The old Greek physicians also knew that it would be wise to avoid the common fallacy of confusing sequence of events with cause and effect. The mere fact that a patient gets well after a doctor has given a drug is no reason for believing that the drug has really helped the patient. The patient might have gotten well anyway. This fallacy is also embodied in a Latin phrase, *"post hoc ergo propter hoc."*

These two considerations lie at the basis of all quackery, and are just as operative today as they were 2,500 years ago. We have, however, learned to control both in the careful clinical evaluation which has now developed in the use of the "double-blind technique" in which the drug to be used is checked against a placebo without either the physician, patient, or the experimenters knowing which is being used in a particular instance until all the records are in. Studies of this sort have revealed how amazingly effective a common placebo may be. Apparently a very great deal depends upon the interpersonal relations between patients and their physicians.

During the nineteenth century with the rise of modern pharmacopeias, the matter of dosage was based on what was considered to be the "average dose" for the average effect desired in an average person. There are thus three intangibles, and there are thus three intangible abstractions, so that from a scientific and indeed from a practical standpoint the "average dose" is relatively meaningless.

The English mathematician, J. W. Trevan (1887-1955), established the scientific basis for a study of the dose-effect relation when he wrote his classical paper on "Statistical Methods for Estimation of Biological Variations in Toxicity Determinations." Trevan was a consultant for Burrough-Wellcome in London and had much to do with the development of biological standardization methods. His quantitation of the dose-effect relationship was greatly extended by A. J. Clark (1885-1941) at the University of Edinburgh. Clark not only analyzed various aspects of the dose-effect relationship, but also extended quantitation to a consideration of time-concentration relationships. Time is an extremely important biological factor, but may be neglected unless it is specifically brought into consideration.

It is rather remarkable that it took so long for a firm scientific basis to be provided for such an ancient idea as the relationship between the dose of a drug and the effect it might produce. There still remain many aspects of dose-effect and time-concentration relationships which are not ordinarily appreciated by physicians or indeed by scientists who may employ chemicals for biological effect. The matter becomes extremely important in a practical way in connection with a physician's judgment respecting the relative merits of similar chemical agents that may be recommended for the same purpose. The principle involved here is to get as wide a spread as possible between the dosage which will produce the effect desired, and the dosage which may produce some unwanted or lethal effect.

Both dosage and the physiological effect resulting from the application of a chemical to living material are capable of increasingly precise measurement. This is what makes possible the development of a full understanding of the dose-effect relationship, and of the time-concentration relationship. These relationships may be increasingly well studied at a micro level, even with the use of individual cells, and in tissue culture. Indeed our fund of scientific knowledge is becoming so great that we may begin to study the action of chemicals on macromolecules as exist within cells. The most exciting problem here is in connection with the action of chemicals on genes and viruses.

Genes and viruses are macromolecules, consisting essentially of a single or paired molecule of deoxyribonucleic acid, coated with protein complexes. When the protein gets stripped off, as occurs under certain conditions, the macromolecules remaining may be directly acted upon by other molecules of other chemicals. When we get to this level of study, we really are beginning to reach an appreciation of ways by which genetic change and the control of major diseases may really be accomplished.

LOCALIZATION OF DRUG ACTION

It is not often realized what a debt is owed by modern medicine to a brilliant French scientist of the mid-third of the nineteenth century. During that time the most alert American physicians went to Paris to study, and they returned to the United States with many important ideas and principles which were reflected in vastly improved medical practice. The French predominance in medical science faded after the Franco-Prussian War in 1872. German precionistic techniques then developed, and American medical science became based on German methods. Many important general theoretical principles relating to the science of pharmacology were established by the foremost Parisian teacher, Francois Magendie (1783-1855), and his pupils.

Magendie with his brilliant pupil, Claude Bernard (1813-1878), first investigated the localization of the biological site of action of chemicals. This was in connection with the location of the target organs on which curare acts. Curare is the crude-plant arrow poison used by South American Indians, which has the amazing property of producing muscular paralysis, from which the animal may recover. Magendie and Bernard localized the site of action in the junction between the motor nerves and the muscles which they innervate.

Historically the localization of the biological site of action of chemicals has steadily proceeded toward the fine details of living material. Initially the localization of the biological site of action of chemicals was concerned with organisms as a whole. The over-all effects of chemicals were well studied and classified.

Gradually, however, chemicals began to be studied with respect to their action on individual organs. Isolated organ technique has been developed to a high degree of precision, particularly by the English pharmacologists, such as the famed J. H. Burn at Oxford. Professor Burn has used isolated organ technique with great skill for establishing standards for drugs.

Later as tissue culture techniques developed under the influence of Ross Harrison and such leaders as Charles M. Pomerat, drug action began to be studied at a specific cellular level. This had been strongly advocated by A. J. Clark, but a satisfactory technique was not available until the tissue culture procedures became well established.

Now more recently it has become possible to study the action of chemicals on macromolecules within cells. Chemicals of course can only react with other chemicals. It is necessary then to understand the molecular structure of cells, including microsomes, mitochondria, and the various nuclear components. It is also essential to begin to understand the structure of the phase boundary between the various parts of cells and between cells and the environment.

The other end of the spectrum of biological organization, namely the social, has scarcely been studied at all. This, however, may become quite important in connection with the religious use of drugs and the use of drugs in warfare. It is also important in connection with the group use of addiction drugs by certain decadent social groups in our society.

One can readily appreciate then that the study of the localization of drug action can be investigated from cells to societies. We should always keep in mind the broad range of biological organization, and realize that any phase of scientific study of a biological nature should include the whole range of biological organization.

ABSORPTION AND FATE OF DRUGS

Magendie also undertook the tentative exploration of the mechanisms of absorption and distribution of chemicals into the mammalian body together with some idea of the way in which the chemical might be removed from the body. This was importantly extended by the great German teacher at Strassburg, Oswald Schmiedeberg (1838-1921). Schmiedeberg also investigated what happens to chemicals in contact with living tissue. Thus there developed a consideration of the significance of the absorption, distribution, fate, metabolism, and excretion of chemicals in living material.

Of prime importance is the study of the absorption of chemicals into cells. How does this occur? For those chemicals that may be ionized, it would seem that the ions may pass through the phase boundary between cells and their environment as a result of chemical gradients, which include electrical pressures, as they may exist between the inside of the cell and the outside of the cell. Factors in Donnan equilibria are of prime importance in the movement of ions into and out of cells. Nevertheless, there are many current problems involving the active transport of ions into cells that remain obscure and that are under intensive investigation.

On the other hand, for large molecules which may not be ionized there are other ways by which absorption into the cell may occur. One of the most fascinating is by the process known as "pinocytosis" or "cell drinking." This was first investigated around 1934, and has since been studied by Charles Pomerat. It involves the sweeping into a cell of a small portion of the environment that may be engulfed in the undulating sweeping movement of the free phase boundary of a cell. This seems to occur even when cells are packed tightly together. It may readily be observed in tissue culture studies.

The absorption of drugs into living material can well be studied by tracer methods, particularly through the use of tagged elements. These radioactive elements may be incorporated in the molecule of various drugs, and these drugs may then be traced throughout the complex organism.

One may study the absorption of chemicals by radioactive techniques into all sorts of living things, from plants to complex mammals, and, further, the distribution of these chemicals throughout the complex organism can be well studied by these means.

Rates of excretion of chemicals from living material can also best be studied by radioisotope means. These studies give very precise information about the absorption, fate, distribution, and removal of various drugs from living material.

The use of radioactive tagged elements for study of absorption, distribution, and excretion of chemicals from the body was first undertaken in the great radiation laboratory group organized by Ernest Lawrence at the University of California in the 1930's.

Among the first such studies of the distribution of radioactive elements was the report by the late Joseph Hamilton (1906-1956) in the Pharmacology Laboratory of the University of California on radioactive iodine. This has subse-

quently been widely applied, not only in scientific studies, but also in practical clinical affairs in connection with managing tumors of the thyroid.

The fate of drugs in the body, as now being well explored as a result of advances of enzyme reactivity throughout the cells of the body, has given a fresh point of view to the way by which drugs are altered and detoxified. The mechanisms of detoxification of drugs are now being well examined, and valuable information is arising as a result.

One of the most interesting practical aspects of studies on the absorption and excretion of drugs has been in connection with the development of chemicals for diagnostic purposes. These were first explored by Rowntree and Gerahty at the Johns Hopkins Medical School in 1910, in connection with kidney function tests. They were later extended to the development of radio-opaque materials for visualizing the urinary tract, and also in visualizing the biliary tract. The success of the diagnostic use of these agents depends on scientific knowledge regarding their absorption and excretion.

THE MECHANISMS OF DRUG ACTION

Another great development from Magendie's Parisian laboratory of more than a century ago was the initial effort to undertake precise study on the mechanisms of drug action. This was explored successfully for the first time by Claude Bernard, the famed pupil of Magendie, when he analyzed so well the way by which carbon monoxide exerts its characteristic biological effects on mammals. For many years this remained the only satisfactory example of a full explanation of the action of a specific drug.

As soon as enzyme systems began to be appreciated, in respect to the control of chemical reactions in the cells of living material, it became possible to postulate mechanisms of drug action based on interference with various enzyme systems. This is now being well explored in connection with drugs that inhibit monamine oxidase.

The effects of chemicals on enzyme systems, as a factor in mechanism of action, was first well appreciated by A. S. Loevenhart (1878-1929) when he showed that cyanides block various kinds of enzyme action. From the early part of this century the actions of many different kinds of drugs have been well explained on the basis of interference with enzyme systems. This may be a predominant factor in chemotherapeutic effects.

A consideration of mechanism of drug action from the standpoint of interference with enzyme effects led to the concept of competitive action of the part of drugs with essential metabolites. This was first explored by D. D. Woods, in connection with the competitive action of sulfa drugs in respect to p-aminobenzoic acid.

In comparison with these more refined methods of studying the mechanism of drug action, the older notions of Paul Ehrlich on chemotherapeutic effects seem crude. Ehrlich simply looked at toxicity in a gross over-all manner, seeking chemicals by empirical experimental means that would have a greater toxicity for invading parasites, than for the tissues and body of the hosts. His success was great, and he did a very great deal to develop basic methods of experimentation in connection with the mechanisms of drug action. Furthermore, his work was an essential preliminary to the development of precision in dose-effect relationships.

BIOCHEMORPHOLOGY: STRUCTURE-ACTION RELATION

One of the most intriguing scientific problems peculiar to pharmacology is the relation between chemical structure and biological action of the chemical. As a basic problem of pharmacology, this again resulted historically from the stimulus of the remarkable Parisian laboratory maintained by Magendie over a century ago.

One of Magendie's pupils was James Blake (1815-1893) who came to Paris in the summer of 1839, to work with Magendie. Blake at the time was a medical student at the University College, London. At London Blake had come under the influence of the great chemist Thomas Graham (1805-1869), and the brilliant physical chemist Michael Faraday (1791-1867). Blake came from a dissenting family at Gosport, and was apparently a young man of great intellectual curiosity. In 1839 Blake published in the *Edinburgh Medical and Surgical Journal* a report on the effects of chemicals introduced directly into the blood stream. He used various preparations of crude drugs, such as tobacco, digitalis, and even some of the recently isolated alkaloids. He measured blood pressure directly with Poisseulle's hemodynameter, which he brought back to London from Paris. Blake first measured circulation time, and developed the concept that chemicals act on target organs.

The next year Blake published in France a declaration of faith. It was to the effect that there must be a relationship between chemical constitution and biological action. He determined to study this, using simple inorganic salts, whose constitution was relatively well known, instead of the recently isolated alkaloids, whose chemical makeup was unknown.

In 1846 Blake had come to several remarkable conclusions: (1) that the characteristic action of an inorganic salt is determined more by the electro-positive element in the salt than by the electro-negative; (2) that if the elements are arranged in order of increasing atomic weight, using the same corresponding salt throughout, there is an increase in the intensity of action or an increase in toxicity; (3) if the elements are arranged in the order of increasing atomic weight, using the same corresponding salt throughout, one will note that similar biological effects reappear, so that the elements may be grouped together in families, and (4) the common characteristic which seems to determine the family grouping of the elements is their isomorphous character. It is clear from these conclusions that Blake had anticipated the periodic table of elements since his "families" correspond to the groupings later shown by the great Russian chemist Mendeljeff (1834-1907).

Obviously Blake was intended for an important scientific career. He was already practicing medicine very successfully, but suddenly left England in 1847 to come to the United States. He worked for a couple of years as professor of anatomy and surgery at the St. Louis University School of Medicine, and then joined the Gold Rush to California. Here he became a leader in scientific development, and later returned to his earlier studies on the relationship between chemical constitution and biological action. He showed that with change of valence there is an increase in the complexity of biological activity.

While Blake's studies were based on a careful investigation of the biological action of inorganic compounds, important findings were made by T. R. Fraser at the University of Edinburgh on the relation between chemical constitution and physiological action in respect to alkaloids. T. R. Fraser (1841-1920) showed

that no matter what the action of an alkaloid containing tertiary nitrogen, the action would always become curare-like if the nitrogen were changed to a quaternary form.

Paul Ehrlich (1845-1915) greatly extended the study of the relationship between chemical constitution and biological action in his investigation of the chemotherapy of protozoan diseases. Other factors also operated. The high price of quinine stimulated search for substitutes. In order to obtain effective synthetic substitutes for quinine, it was necessary first to establish the chemical structure of quinine. This turned out to be a very difficult task. Nevertheless it was found promptly that certain chemical radicals associated with quinine had something of the same action. This led to the development of the antipyretic analgesics, including aspirin, which is probably the safest and most widely used drug there is.

Currently there are many investigations involving relationships between chemical constitution and biological action. Many young chemists begin their professional careers by synthesizing various relatives of well-known drugs in an effort to find something that may be an improvement on that which is already known. Sometimes these studies assume enormous importance, as when effective antimalarial drugs were being sought during World War II. Hundreds of thousands of drugs were screened in this process. The same sort of thing is going forward now in connection with drugs that may have an action in cancer.

PROTOPHARMACOLOGY

The science of pharmacology, as the study of the action of chemicals on living material, has now prospered well over a century. It has made many significant contributions. As a science, however, pharmacology was impossible until chemicals of constant physical-chemical properties became available. Crude drugs vary too greatly in makeup, and thus in biological effects, to permit anything better than deductions of a rough nature with regard to their biological effects.

Such lore had accumulated for centuries. It was applied to medical problems with varying success. From the medical folklore of primitive peoples, through the Egyptian medical papyri, through the magnificent compilation of Nero's surgeon, Dioscorides, through the works of Galen (130-200), Avicenna (980-1037), and the medieval compilers, to the Renaissance herbals and the complexities of eighteenth century pharmacopeias, this empirical method continued.

Polypharmacy developed during the ascendancy of the Arabic compilers of the ancient drug lore. Complex prescriptions containing many ingredients probably arose during the process of transcription, when the compiler found several materials recommended for the same purpose with no indication of relative value. Under these circumstances it was natural to combine them all in the same prescription. This tendency remained prominent from the Middle Ages to the nineteenth century.

A different system had been originated by Dioscorides, the Greek surgeon in the armies of Nero. He described as carefully as possible the individual crude materials of plant, animal, and mineral origin used in medicine, then indicated how each was to be prepared and administered and for what purposes each might be used. This method of organization on the basis of the drug used rather than upon diseases to be treated was the basis for the development of modern pharmacopeias.

Pharmacopeias, or reference books of standardized medicinal preparations with legal authority, arose in the sixteenth century. They met the obvious necessity of making uniform the various modifications of the same recipe as prepared by different apothecaries. They enabled the physician ordering the formulary to expect some reasonable degree of uniformity of effect and response to dosage.

This problem of dose-effect relationships became significant as the art of distillation was developed by the alchemists, since many of the "elixirs" were recognized to be potentially toxic, although they were developed as pathetic efforts in the quest for eternal youth. Paracelsus (1493-1541) helped in the effort by popularizing "tinctures" and by recommending relatively simple preparations of such substances as sulphur, iron, and arsenic. The detailed letter of the anatomist Andreas Vesalius (1514-1564) on the China Root also was influential in emphasizing the need for drug standards and regulations.

The first genuine pharmacopeia was the formulary authorized by the Senate of the City of Neuremberg around 1546. It had been compiled by that brilliant youngster, Valerius Cordus (1515-1544). This example was quickly followed all over Europe, and physicians for the first time were able to prescribe preparations of uniform composition when ordered. A significant principle was recognized of furnishing a standardized and uniform complex formula under a relatively simple name. By specifying standards for the ingredients and for methods of compounding, the pharmacopeia made it possible to detect adulteration and thus to protect on the one hand against ineffective materials, and on the other hand against toxic effects from overdosage with unknown amounts of dangerous drugs.

Following the Renaissance, sporadic experiments began to be made with drugs on animals, usually to test suspected toxicity. Thus Johannes Wepfer (1620-1695) demonstrated nux vomica tetanus in dogs. Anton Storck (1731-1803) critically examined the actions of stramonium, hemlock, and aconite. Felice Fontana (1730-1803) made a remarkable toxicological survey involving some 6,000 experiments. These led him to the fundamental idea that general symptoms are produced by drug action on particular organs. Thus was the way cleared for modern pharmacology.

THE DEVELOPMENT OF MODERN PHARMACOLOGY

Modern pharmacology developed with chemistry. A. L. Lavoisier (1743-1794) promoted the concepts of modern chemistry by precision measurement. His analytical procedures stimulated the analysis of crude drugs.

Some pure chemicals had been used in medicine for quite a while. Richard Glauber (1604-1688) had introduced sodium sulfate as a saline purgative. Even in the tenth century the Arabs used elemental mercury in lard or ointments for the treatment of skin conditions, and this was immediately applied in the fifteenth century when syphilis was first recognized as an important disease. Mercury still remains one of the most effective agents for use in syphilis.

To Friedrich W. Sertürner (1783-1841) should go the credit for first isolating a chemically pure active principle from a crude drug. His work started around 1803. From the anciently used pain-relieving crude drug, opium, Sertürner obtained by ammonia precipitation a white crystalline compound which he found to be a powerful narcotic agent. He named it morphine from the Greek or Roman diety of sleep. By direct experimentation he found that morphine is effective in small dosage. Since he found no other constituent of morphine that produces

the characteristic effects of morphine, he concluded that the valuable medicinal properties of opium are due to its presence.

This discovery stimulated the development of pharmacology in a very broad way. Now with a pure chemical agent, whose physical-chemical properties could be accurately determined, it was possible for the first time to measure dosage in terms of mass of chemical per mass of living material, and thus the concept of a quantitative relationship between dose and effect could be studied.

While physicians were slow to grasp the significance of this new idea, its theoretical application was promptly taken up by the French, particularly under the influence of Francois Magendie, the great Paris teacher. Within a few years, Joseph Pelletier (1788-1842) and J. P. Caventou (1795-1877) had isolated, under Magendie's influence, such chemicals as emetine from ipecac, strychnine from nux vomica, and quinine from cinchona bark. By 1821 Magendie was able to issue a medical formulary based entirely on pure chemical agents.

These same methods of chemical analysis were to be followed with respect to all sorts of crude drugs, and are now being applied to the conventionalized crude drug lore of China and India. Ephedrine was isolated from an anciently used Chinese drug by K. K. Chen, and reserpine has recently been isolated from an anciently used Hindu drug. Currently the intricate complexities of crude preparations of hormones, vitamins, enzymes, and even viruses are yielding to a similar technique.

A notable further development occurred when attempts were made to improve on a natural product. These efforts began with the rise of structural organic chemistry. The high price of quinine and its great demand led to the synthesis of many valuable antipyretics, whose structure was affirmed from the evidence existing for that of quinine. Richard Willstatter (1872-1945) clarified the structure of cocaine (introduced as a local anesthetic by Carl Koller in 1884) and this made possible the synthesis, for desired local anesthetic action, of substances less toxic and more efficient than the natural product. This process of improving on nature is now routine in pharmacological study.

While a consideration of the relation between chemical structure and biological action is basic to the proposition of trying to develop synthetic drugs that can improve on those found in nature, few satisfactory generalizations have emerged. Results are still achieved by laborious empirical testing of chemical relatives, rather than by confident rational prediction of the properties of a specific compound. We are getting to the point, however, where we can set up specifications for certain kinds of drugs that we may want and tailor them chemically to get the results we desire.

This sort of procedure has been followed in the development of such drugs as amphetamine. The initial isolation of epinephrine from the blood pressure raising principle of the adrenal medulla led first to the recognition of its chemical structure and then, under the influence of Sir Henry Dale, to the preparation of many chemical relatives, all of which have "sympathomimetic actions." From this study first came ephedrine, as developed by K. K. Chen, and later amphetamine, as developed by Gordon Alles.

The steps in the characteristic pharmacological sequence are: (1) the recognition of the biological activity of a crude preparation from which; (2) the biologically active principle is eventually isolated in chemically pure form, free from contaminating material, so that its physical properties are constant; (3) the establishment of the chemical structure of the substance; (4) the synthesis

of its chemical relatives; (5) the laborious pharmacological appraisal of all available related compounds; and finally (6) the choice of the one best suited to the peculiar application in mind.

For medical purposes such a choice is usually made on the basis of toxicity, effectiveness, ease of administration, stability, and cheapness of production.

Many practical achievements with drugs have resulted in stimulus to theoretical research. For example, the practical success of Crawford Long (1815-1878), W. T. G. Morton (1819-1868), and J. Y. Simpson (1811-1870) in anesthesia focused attention on the problems of the specific mechanism of action of particular drugs. By no means have we succeeded in explaining anesthesia, so that the problem is still with us after more than a century of intensive study.

Important surveys of drug action have been made by B. W. Richardson (1828-1896), A. R. Cushny (1866-1926), Karl Binz (1932-1912), H. C. Wood (1841-1920), Ernst Fourneau, and Sigmund Frankel. These men compiled important texts, based on the work of many brilliant individuals. The first great text in pharmacology was that compiled by Rudolph Buchheim (1820-1879) in 1856. Robert Christison (1797-1882) developed one of the first scientific toxicologies. This field was expanded by J. G. Dragendorff (1836-1898) in St. Petersburg, and then by E. R. Kobert (1854-1918), and Louis Lewin (1850-1929).

Details of chemical indentification, especially in relation to toxicology, were worked by M. B. J. Orfila (1787-1853) and in this country by R. A. Witthaus (1846-1915).

An important extension of the work of J. W. Trevan in establishing pharmacology on a quantitative basis, in respect to the dose-effect relationship, has been the development of bioassay, especially by J. H. Burn at Oxford. This has become very important in the establishment of drug standards for such drug preparations as cannot be satisfactorily handled by chemical means. As long as agreement is reached on the particular sample of the drug to be used as the standard, any unknown preparation of the same material can be assayed against the standard so that its biological activity can be estimated. This remains the basis for the use of many crude drug preparations, such as hormones, certain vitamins, and especially biological products such as vaccines and antitoxins.

In spite of the stimulating ideas of W. S. van Leeuwen (1882-1933) on unusual drug reactions, the simple fact is that chemical agents generally are capable of altering biological function in a quantitative way only. Drugs can merely make living material do more or less what it is already capable of doing. No drug can make a muscle cell secrete saliva. It is important to take into account the "tonic" activity of cells, in order to determine whether or not a foreign chemical agent is really producing a response. Statistical control has become a necessary part of pharmacological technique.

APPLICATIONS OF PHARMACOLOGICAL KNOWLEDGE

Pharmacology is a rapidly growing science. It has broad interrelations with many other biological sciences. Currently pharmacological studies are adding much excitement to our exploration of the way in which brains work. The whole field of neuropharmacology has blossomed enormously as a result of general public acceptance of experimentation involving disturbance of ordinary brain function.

In addition to a vast number of "tranquilizers" and other mild depressant agents, it is now possible to develop a large number of "energizers." The latter seem to be agents which generally inhibit monamine oxidase and thus permit accumulation of certain types of metabolic amines in the brain and brainstem, which seem to promote increased activity and mental energy. These amines are relatives of epinephrine. In addition many chemical agents that produce distortion of mental activity are being used to produce experimental hallucinations and other distortions or sensation and perception. These studies are creating a whole new subdivision of pharmacology that is being intensively explored.

In addition to finding application in many other forms of biological science, pharmacology has direct application in many aspects of professional work. Its most obvious applications, of course, are in the health professions.

Historically pharmacology has long been associated with the medical profession. The obvious applications of pharmacological knowledge occur in connection with the use of drugs to aid (1) in the diagnosis of disease, as in the use of chemicals in functional tests; (2) in the prevention of disease, as with the use of antiseptics or of vitamins; (3) in the "cure" of disease, as in the removal of infecting parasites by chemotherapy, including the antibiotics; and (4) in the alleviation of the symptoms of disease. The greatest number of drugs are used in the alleviation of symptoms.

Similarly, many applications of pharmacology are made in dentistry. Notably here the local anesthetics are most widely employed. Many applications of antiseptic action are also used in dentistry, as well as various drugs for metabolic effect with reference to the teeth. The current furor over fluoridation of drinking waters, to prevent dental caries, is essentially a pharmacological problem. Pharmacologists generally favor the proposal.

Pharmacology may be considered to be the basis for the art of pharmacy. After the biological action of a chemical has been established and some indication found for its use, it is up to the pharmacist to prepare the chemical in an appropriate way for administration. This is a great art. It involves consideration of absorption, distribution, and removal of the drug from the body. Many brilliant new advances have been made, particularly in prolongation of absorption, prolongation of action, and promotion of palatability or ease of administration.

Pharmacology is a necessary part of the nursing profession. All nurses must have information regarding the possible untoward or toxic action of drugs, so as to be able to inform the attending physicians whether or not anything is going wrong in medication. Nurses also are usually responsible for the administration of drugs, and should have very clear knowledge of precise measurement and details of giving drugs.

Pharmacology is widely applied in public health, particularly in the control of drinking waters and in the mass use of disinfectants for control of infectious disease. The wide use of chemicals in all phases of industry makes it necessary for physicians and public health workers to know a great deal about the toxicity of all kinds of chemicals that may never be developed for medical use. It is necessary that this information on toxicity be obtained in order to protect workers against the dangers of many industrial chemicals and also to be able to treat such workers, or consumers, if toxic reactions occur.

An extremely broad field for application of pharmacology is developing in veterinary medicine. This involves not only the control of various diseases in domesticated animals and in poultry, but also in such matters as increasing rate of growth, modifying sexual development, and even controlling fertility.

Similarly pharmacology is a subject that finds wide application in many auxiliary fields to medicine. Laboratory and radiation technologists, for example, apply pharmacological knowledge frequently in connection with technical details of their work. Even physical therapists apply pharmacological knowledge in connection with chemical agents used in massage. Social workers may use pharmacological knowledge in connection with management of families or individuals in whom excessive use of drugs may be found. The whole matter of drug addiction is a proposition of concern for social workers, as well as for psychologists who may be involved in medical affairs.

Wide applications of pharmacology are occurring in agriculture. This is important in control of crops, in promoting rapidity of growth, in ripening fruits, and in the development of desired mutants. These same considerations apply to the applications of pharmacology in forestry. Indeed chemicals may widely be used on a broad ecological basis to maintain desirable features in a wide natural setting.

Here the matter of pest control may become important. Pharmacological knowledge, and especially details of toxicity, may be widely applied in the control of insect pests both on an individual basis and on a mass scale. The control of insect vectors may be very significant in the prevention of mass epidemics. Pest control also extends to rodents and other undesired living things. Much ingenuity can be used in the applications of pharmacology to pest control. However, in regard to pest control, a prime consideration must always be to disturb the balance of nature as little as possible.

Extensive applications of pharmacology and toxicology occur in chemical warfare. This is not only involved in the use of tear gases or of irritating vapors, such as used in World War I, but also in regard to new and highly poisonous "nerve gases" and other chemicals which could be used on a broad scale in warfare. Indeed it is even seriously proposed that volatile tranquilizers could be used to take the fight out of large masses of enemy troops or of enemy people.

Indeed the applications of pharmacology in sociology are becoming very broad. Here are raised the questions as to the ethical use of drugs under various circumstances and conditions. Are pain-relieving drugs ever justified in euthanasia? What is the best way to handle the social aspects of drug addiction? How about the use of drug for criminal purposes? How far should there be social control of the sale and distribution of drugs? How far should governments go in controlling the use of drugs, either on an individual basis or under the direction of physicians?

Many of these problems regarding the applications of pharmacology involve legal matters. The development of law in relation to pharmacology and toxicology is ancient and significant. The problem of determination of poisoning has been a prime legal one since the Renaissance. Now, however, much broader aspects of pharmacology and toxicology are involved in legal affairs. These concern legal restrictions on the manufacture, sale, distribution, and adulteration of drugs. The current matter of "food additives" is being approached from a legal standpoint.

CLOSING NOTE

Pharmacology is a broad and rapidly growing scientific field, with specific scientific problems that differentiate it from any other scientific discipline. These problems involve various aspects of chemistry and biology. Pharmacology is

thus a bridging science, and requires an extensive scientific background for its effective cultivation.

Pharmacological knowledge has vastly increased during the past century. It has produced many important chemicals that have aided materially in the control of disease, and in the promotion of optimum health and good living. Pharmacology currently is being applied widely through the health professions to agriculture, pest control, warfare, sociology, and even law.

Pharmacology is a very stimulating and exciting field. It takes broad intelligence to encompass its wide ramifications, and it can provide a solid foundation of effectiveness for human welfare.

ADDENDUM

A Title List Toward a Critical Bibliography of Pharmacology

The Classics

Avicenna (980-1037) (Abu ali Husain ibn Abdallah ibn Sina)

The second part of his monumental *Qānūn* treats of drugs, and was a standard for centuries. A full bibliography of translations of and commentaries on Avicenna is given in George Sarton's *Introduction to the History of Science,* 1:711-713, Washington, 1927. There is no translation or appraisal of his materia medica in English.

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EARLY HISTORY OF ANTISEPTICS AND DISINFECTANTS*

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A review of the early history of antiseptics and disinfectants may be of interest for two reasons, first, because of the logic and intelligence displayed in the original use of germicides to prevent infection and the spread of disease and, second, because of the inherent value and special properties of the compounds employed. This is even more intriguing since these germicides were used originally before the cause of infectious diseases was discovered.

Although the early Egyptians considered that infection and disease could be transmitted by contact and the early Hebrews established specific rules of cleanliness and disposal of waste, and preventive measures with respect to leprosy, and although Aristotle advised Alexander The Great to require his armies to "boil the drinking water and bury the dung," nothing whatever was then known as to the cause of disease. Many, many centuries later, in 1663 to be exact, Robert Boyle suggested that a knowledge of the cause of fermentation would lead to a knowledge of the cause of disease, and still later Jacob Henle in 1840 proposed a set of rules for determining the specific "contagium animatum" for each disease, which rules later became the famous Koch Postulates, published in 1881.

In spite of the prophecy of Robert Boyle almost twenty years passed after the cause of fermentation was discovered before the causes of certain diseases were discovered. However, Pasteur's discovery of the cause of putrefaction in 1863 led to the use of germicides for the prevention of infection in a very peculiar manner.

In these very early days infection such as suppuration following surgical operations was considered a form of putrefaction. Shortly after Pasteur proved that putrefaction was caused by "living ferments," Lord Lister in 1865 began the use of a compound which had previously been used for deodorizing sewage. Since Lister considered postoperative infection to be putrefaction, and since Pasteur proved that "living ferments" caused such decomposition, and since carbolic acid was known to be effective in preventing putrefaction in garbage and sewage, he decided to use this compound in surgery solely on account of its deodorizing property. He used 5.0 per cent carbolic acid on surgical instruments and operating room equipment and 2.5 per cent for use on the operative area and in the wound during operations. The results were spectacular, and the use of this germicide became the foundation stone of modern surgery, the basis of Lister's system of antiseptic surgery. It is of interest to note that the actual cause of postoperative infections was not discovered until almost twenty years after Lister began the use of carbolic acid for "deodorising" purposes, and he did not know until much later that the compound he used was actually germicidal.

Semmelweis had somewhat the same experience in reducing the incidence of puerperal sepsis by the use of chlorine solutions. When he was appointed assistant in the great Lying-in Hospital in Vienna he noticed a much higher

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rate of puerperal sepsis in his wards than in the others, and he became quite curious as to the reason. He noted that the medical students assigned to his ward would come directly into the ward from the adjoining autopsy room and that the foul odor of the cadavers was especially pronounced on their hands. Purely as a cleansing and deodorizing precaution he required the students to wash their hands in chlorine solution before leaving the autopsy room and before assisting in delivery in the ward. Semmelweis had learned previously in his chemistry course that chlorine solutions were effective as deodorants, and his purpose in having the medical students wash in such solutions was only to deodorize the "decomposing organic matter." As a result the death rate in his ward dropped from 12 per cent in May, 1847, before the use of chlorine solution, to 3 per cent seven months later, and to 1.27 per cent the following year. However, Semmelweis did not know that these favorable results were due to anything but the deodorizing effects of chlorine, and it was not until some thirty years later that the reason became known with the discovery of the cause of these infections, and somewhat later with definite information as to the germicidal property of chlorine solutions.

Even before Semmelweis, Oliver Wendell Holmes in 1830 stated his conviction that puerperal sepsis was transferred from diseased to healthy patients by physicians and nurses, and in 1835 reported success in preventing communication of such infections by washing the hands in chloride of lime solutions after each visit to an infected patient. While it may seem that too much credit has been given Semmelweis in this connection, he was the first to use this method in a large lying-in hospital and the first to preserve a careful statistical analysis of his results. He published these results in a series of papers from 1847 to 1849 and subsequently in his famous "Aetiologie" in book form in 1861. Although others had reported briefly on a few cases, he presented conclusive proof based on a large number of cases. It must be noted again that the results obtained by all who used chlorine solutions for this purpose were attributed to the deodorizing effects of chlorine since it was not known until later that these infections were caused by bacteria and that chlorine solutions are germicidal.

There were others who used germicidal solutions for deodorizing purposes before the cause of infection was known. Labarraque in 1825 used chlorinated soda solutions in the treatment of infected wounds and for general disinfection, and Alcock in 1827 introduced chlorine solutions into England and recommended chlorine for the purification of water. At this time it was also used in France for washing the hands and as an aid in the treatment of so-called "hospital gangrene." Still later Kuchenmeister in 1860 recommended carbolic acid in place of chlorine solutions, and in the same year Lemaire used it in wounds, and then Lister published his results on the use of carbolic acid in surgery in 1867. Other uses of carbolic acid in medicine were reported by Bill in 1872.

Solutions of iodine were also employed as antiseptics even before the cause of infection had been determined. Although tincture of iodine was admitted to the U.S. Pharmacopeia in 1830 and the compound tincture in 1840, it was not used widely in surgery until after 1860. It was first used in the treatment of battle wounds during the American Civil War in 1862. Later, as the cause of infection became known, the germicidal properties of iodine solutions were recognized, and these solutions were used successfully in surgery, first aid, etc. At about this time the germicidal properties of alcohol were also demonstrated.

During this period mercuric chloride was used to a large extent in place of carbolic acid. The intelligent use of germicides began during this period, that is following the discovery of the cause of infection and infectious diseases.

The decade of the 1880's was marked by the discovery of the causes of many infectious diseases, including the cause of postoperative infections, suppuration, puerperal fever, and many others. During this period the use of germicides, both antiseptics and disinfectants, became general in all enlightened countries, and the benefits of such use were widely recognized. The value of such germicides when used in practice was readily demonstrated, and their employment in medicine and by the public became widespread.

It will be of interest to note and evaluate the properties of these early germicides in terms of their value when used in practice. Since these antiseptics and disinfectants were proved effective under practical conditions of use, it became quite evident that their performance was based on certain desirable properties. Some of these germicides are still being used, and others have been discarded in favor of more suitable compounds developed later.

First it is desirable to define the words "antiseptic" and "disinfectant" as they are used at the present time. Antiseptics are drugs which are used to destroy or prevent the growth of infectious microorganisms on or in the human and animal body, that is on living tissue. Most antiseptics used at the present time are germicides which kill the vegetative forms of bacteria, viruses, and fungi, but not bacterial and mold spores. Disinfectants, on the other hand, are chemical substances which are used to destroy infections and other harmful microorganisms on inanimate objects. Such germicides kill the vegetative forms of bacteria and also viruses, but not necessarily bacterial and mold spores. These are legal definitions and as such are employed in the control of these products by governmental agencies.

Although chlorine solutions were effective in reducing death from puerperal fever from 12 per cent to 1.27 per cent by the simple procedure of washing the hands with it, such solutions were not and are not now considered ideal for the purpose. One reason for this is that chlorine solutions are counteracted to varying degrees by organic matter, have a high surface tension in water solutions, are not penetrative, and have other undesirable properties as antiseptics for use on living tissue. However, they have been proved useful as disinfectants on inanimate objects after organic matter has been removed and are still employed for certain purposes such as in dairies, food establishments, restaurants, etc.

Carbolic acid and other phenol compounds are effective germicides both as antiseptics and disinfectants. They are not appreciably affected by organic matter, but because of their toxicity and caustic action on tissue are not especially suited for use as antiseptics. Carbolic acid and other phenolic compounds are, however, eminently suited for use as disinfectants on inanimate objects. As a matter of fact, the 5 per cent solution of carbolic acid used by Lister and others is still recognized as effective for the purpose and in the United States is still employed as the standard of excellence in evaluating the germicidal activity of disinfectants generally and is used for this purpose by governmental control agencies.

This being the case and since phenolic disinfectants have been proved effective germicides under conditions of use since the middle of the last century, it will be of interest to list the desirable properties of the phenolics for the purpose.

Carbolic acid and the other phenolics are nonspecific in germicidal activity; that is, they kill all kinds of infectious microorganisms, including bacteria, fungi, and viruses, and maintain this property in the presence of organic matter, possess continued antibacterial potentials following application, not counteracted by hard water, effective in various degrees of acidity and alkalinity, low surface tensions in usual formulations, nonvolatile, stable under all conditions of storage, and inexpensive in use-dilution concentrations. In addition practical performance experience in the use of phenolics during the past ninety years or more has fully confirmed the value of this class of compounds as general disinfectants.

While carbolic acid solutions were used as antiseptics by Lister and many others for several years, there was considerable objection to their use because of toxicity and destruction of tissue. For this reason mercuric chloride solutions were used as a substitute for phenol for many years because they were less caustic. However, mercury compounds, especially inorganic mercurials, are readily counteracted by organic matter, are themselves toxic and corrosive, and are not as positively germicidal as was at first considered. Although laboratory tests conducted at the time indicated the superiority of mercuric chloride, later performance tests and clinical experience were disappointing, with the result that such solutions were replaced by other and better germicides.

The best of the early antiseptics used in place of carbolic acid and mercuric chloride was tincture of iodine. Although used to some extent since 1862, tincture of iodine was not generally employed in surgery until after the turn of the century following the detailed and extensive reports by Senn and Kinneman in 1905 and by Grossich in 1908. For the past half century at least tincture of iodine has proved an efficient germicide for use in surgery, especially as pre-operative skin preparation, for first aid use, etc.

There are valid reasons why tincture of iodine has proved so effective as an antiseptic when used in practice. The following desirable properties may be mentioned: It is highly germicidal and nonspecific in its germicidal activity, is not appreciably affected by organic matter, has low surface tension and penetrative power, has low pH which accentuates its germ-killing power, and in usable solutions has a high margin of germicidal activity. Although it is germicidal by standard laboratory test in 0.02 per cent concentration, it is used in surgery and first aid as a 2 per cent solution in alcohol, a factor of considerable importance in clinical use. This is an excellent example of an "old" antiseptic which is presently widely used in hospitals, general medical practice, first aid, etc. Because of these desirable properties of tincture of iodine and recent further confirmation of its germicidal performance and clinical effectiveness under conditions of use, there is a present trend toward greater emphasis in the use of this antiseptic in these various fields of application.

Another example of an "old" antiseptic which is still employed widely in this country and abroad is an alcoholic solution of essential oils. Developed in 1881, this antiseptic was admitted to the U.S. Pharmacopeia VIII (1900) as Liquor Antisepticus and later in National Formulary IV (1916) and is still included in the present National Formulary. While thymol is the most active ingredient in this formulation the other essential oils included in a synergistic manner, and although the concentration of these oils is low the final combination is highly germicidal. In fact this antiseptic is equal in germicidal activity to the 2.5 per cent solution of carbolic acid so successfully used by Lister and others in antiseptic surgery.

Since this is an example of an antiseptic developed almost eighty years ago and is still recognized as sufficiently effective to be listed in official compendiums, it will be of interest to list the desirable properties which it possesses. In the first place, as just noted, it is equal in germicidal activity to 2.5 per cent phenol which is the standard of excellence in official laboratory methods of testing antiseptics generally. Furthermore, it is nonspecific in its germ-killing property and kills all varieties of infectious microorganisms, including bacteria and viruses, but not spores. This formulation also combines low surface tension, low pH, stability in the presence of organic matter, and in addition is nontoxic and noncaustic and safe to use on all body tissues, and is stable under all conditions of storage. In most respects alcoholic solutions of essential oils as represented by Liquor Antisepticus are comparable to tincture of iodine and have been proved effective in a wide variety of clinical applications, first aid, etc.

While many new and useful antiseptics have been developed since chlorine solutions, carbolic acid, iodine, and essential oils were first used, it is evident that these early germicides were effective for the purpose. The same is true of disinfectants in that chlorine solutions and phenolic compounds were then and still are recognized as effective for use on inanimate objects and are still widely used for this purpose. It is evident that the so-called "old" antiseptics and disinfectants were and are excellent germicides and as such represent satisfactory standards of excellence for evaluating newer developments in this field.

SUMMARY

Early germicides used as antiseptics and disinfectants were effective for their respective purposes when used in practice. They were and are nonspecific in their germicidal activity, were not counteracted appreciably by organic matter, and possessed many other desirable properties. Their use constituted the foundation stones of modern surgery and sanitation and they are still considered as standard for the evaluation of later developments.

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LLOYDS OF CINCINNATI*

GEORGE D. BEAL

In August of this year the American Pharmaceutical Association will meet in Cincinnati. This will be the first meeting in the Queen City since 1887, an abstention of seventy-two years. Among the local persons having an active part in the meeting was John Uri Lloyd, pharmacist, teacher, and pharmaceutical manufacturer. In those years the Association elected its officers by acclamation after the report of the nominating committee. From the minutes of that year I shall quote some paragraphs that follow the committee's report.

> Mr. Lloyd was recognized. 'I notice heading that list is the name J. U. Lloyd. I thank my friends—the members of this Association—for the honor conferred on me through their Nominating Committee, but, Mr. President and members of the American Pharmaceutical Association, I beg of you to relieve me now from that position. I am not fitted to fill it. My work has been entirely in another direction. Relieve yourselves and relieve me at the same time, I ask you.'
>
> Several members spoke in opposition to the wish expressed by Mr. Lloyd, and Mr. Sander asked the unanimous consent of the Association that the Secretary cast the affirmative ballot for the officers nominated.
>
> The Chairman—'Gentlemen, it affords me great pleasure to introduce to you your President. I introduce him now to the members, not because it is necessary, for every pharmacist in this country knows him by reputation, but in order that we may congratulate the Association on their selection and election.'
>
> President-elect Lloyd—'Gentlemen of the American Pharmaceutical Association, I had expected that I should not be compelled to address you; therefore I have nothing prepared. I can only say to you that in the City of Cincinnati I have been simply a pharmacist for a quarter of a century, and I see in this audience the two gentlemen with whom I learned the business. I feel, as I address you, that if thanks are due to any, they are certainly due to these two gentlemen. I have followed their instructions, and have endeavored in no way to step outside of my profession. I feel that you will have much to bear with while I occupy this chair, and I beg of you to overlook my shortcomings. I thank you sincerely for this high honor, which I duly appreciate, and I trust that our meetings may be pleasant.'

This disclaimer was not any false show of modesty, it was typical of his willingness to put self aside if he could render service. Forty years later I had the good fortune to have his friendship, and towards the end of his life I came to him for help on a very important industrial problem. His reply was like his reply to the Association. "I'm getting old, and there are many things that I have planned to do and have not yet done. But you have interested me, and I think that my extractor will do your work. I'm going to build it for you.

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*This article was prepared at the invitation of the Editor.

The author has deliberately avoided the incorporation of a mass of biographical data. Those seeking a well-documented source for this are referred to the Lloyd Library and Museum, Cincinnati, Ohio, whose Librarian, Mrs. Corinne Miller Simons, has painstakingly sought out and assembled a superb collection of Lloydiana. The following references will be of especial interest.

"John Uri Lloyd—Selected Biographical Sketches" *Eclectic Medical Journal,* Vol. 96, No. 5, May, 1936.

"Curtis Gates Lloyd, Mycologist, 1859-1926" Corinne Miller Simons, *National Eclectic Medical Quarterly,* September-December, 1951.

"Sophia Webster Lloyd, 1820-1903, Mother of the Lloyd Brothers" Corinne Miller Simons, *ibid.,* June-September, 1953.

"Nelson Ashley Lloyd, 1851-1926" Corinne Miller Simons, *ibid.,* September-December, 1955.

not for them." When the equipment was finished his face beamed as he watched the unit, larger than any he had ever dreamed of building, behaving as he had predicted and effecting every promised economy.

The annals of pharmacy report all of the scientific accomplishments of John Uri Lloyd, but too little of him personally and of his two brothers who played such important roles in the family achievements. It will be more appropriate to use this space to tell of the Lloyd family. The mother, Sophia Webster Lloyd, was of the same lineage as the lexicographer Noah Webster, a descendant of John Webster, Governor of Connecticut in 1656, her father being Uri Webster, a woolen manufacturer. The father was Nelson Marvin Lloyd, great-grandson of John Lloyd who came from Wales in 1770. Nelson Marvin's father was a tanner, and the family had many common interests, including the fact that their children were attending Lima Seminary and College in New York State at the same time.

Nelson Marvin Lloyd was a school teacher, surveyor, and civil engineer. He surveyed the route for a railroad from Canandaigua to Niagara Falls, now a part of the New York Central, and the reason for his coming to the Cincinnati district was to survey for a line between Covington and Louisville, Kentucky. That line was never built because of financial difficulties, so Mr. Lloyd returned to teaching. Sophia Lloyd was a more than ordinary writer of poetry and short stories. Father Lloyd and his family moved to Petersburg, Kentucky, near the famous Big Bone Lick, where the father and mother conducted the village school. During the vacations from teaching the father usually joined surveying parties, and his death came from an illness contracted on one of those occasions.

John Uri Lloyd was born in West Bloomfield, New York, in 1849, and Nelson Ashley Lloyd in North Bloomfield in 1851. Curtis Gates Lloyd was born in Florence, Kentucky, in 1859. All three of the boys enjoyed schooling under their parents' supervision. John Uri began his apprenticeship in the pharmacy of W. J. M. Gordon in Cincinnati in 1864, and from there went to the store of a well-known German apothecary, George Eger, so that his training was of the most rigorous sort. In 1871 he joined the firm of H. Merrell & Company, manufacturing chemists, as manager of their laboratory, becoming a partner in 1877. Nelson Ashley Lloyd came into the firm at about that time, and the firm name became Merrell, Thorp, and Lloyd. The name later became Thorp and Lloyd Brothers and, in 1885, Lloyd Brothers, when the youngest boy, Curtis Gates Lloyd, became a member.

Ashley Lloyd's boyhood wish was to become a river pilot, but circumstances and his father's advice turned him to the drug business. He finally became the financial head of Lloyd Brothers. He was quiet and unassuming, but nevertheless genial and companionable. He became a leader in civic affairs, had a high standing in Freemasonry, and was well known in the artistic world as a collector of paintings. Together with John T. Brush he became a co-owner, and himself secretary-treasurer, of the Cincinnati Baseball Club. They later sold their shares to August Hermann, Julius Fleischman, and George B. Cox, and bought control of the New York Giants, an interest that Ashley held almost to the end of his life.

Curtis Gates Lloyd began his career in pharmacy at the age of fifteen in Crittenden, Kentucky, and at eighteen came to Cincinnati to join his brothers, working in a retail pharmacy. He became a registered pharmacist, then joined a wholesale drug firm, leaving that to be bookkeeper and manager of a publishing

company and learn the details of book publishing. When Curtis Gates was fourteen his brother John Uri sent him a copy of Wood's *Classbook of Botany*, a gift that completely shaped the future life of the boy. Botany became his life, chemistry and pharmacy only adjuncts thereto. An orderly thinker, he began the collection of a herbarium, and through more and more specialization finally limited himself to the field of mycology. When John Uri and Nelson Ashley became sole owners of Lloyd Brothers they offered Curtis Gates a one-third interest in the firm, stipulating that he was to devote his time to the identification of plants that might have medicinal value. John Uri's responsibility would be the chemical and pharmaceutical study of the thus identified plants, while Nelson Ashley would guide the business interests.

John Uri's professional work attracted the attention of Dr. John King, a leader of the Eclectic school of medicine, bringing to him the professorship of chemistry and pharmacy in the Eclectic Medical Institute of Cincinnati, and, later, a similar chair in the Cincinnati College of Pharmacy, which he finaly gave up as his business affairs demanded more and more of his time. John Uri was an avid reader and a tireless investigator. Every product of the company became a subject for experimentation, not from the viewpoint of standardization, though that was never neglected, but from the desire to learn what was actually taking place during the life processes of the plant and under the conditions of manufacture and storage of the medicinal.

John Uri early reached the same conclusion as Dragendorff, that plant tissue was not a heterogenous mixture of chemical substances, but a structure of discrete cells, each of which was a vessel or container devoted to the elaboration of storage of some one of a number of characteristic components of the plant. He saw, as Dragendorff did, that extraction with menstrua of low specificity simply made possible the chemical interaction of the several cell contents, so that the educt might not in any way actually represent the characteristics and properties of the drug itself. This inspired the devising of a continuous extractor that avoided the continued exposure of the drug and extract to elevated temperatures that promote hydrolysis and other destructive reactions, yielding eductive preparations quite different from the classical fluidextracts. Although the so-called "specific medicines" thus prepared were intended for eclectic practitioners, they were widely accepted by other physicians and pharmacists, and the principle of that type of extractor was favored by many other investigators.

John Uri was probably the first to employ a base-exchange silicate in pharmaceutical operations. The hydrous aluminum silicate which he used for the recovery of alkaloids from solutions of their salts is catalogued as Lloyd's Reagent. The tasteless alkaloidal salts thus prepared were known as "Alcresta" preparations. It was his custom to demonstrate their stability in acid and their availability in alkaline media by asking his visitors to taste the "Alcresta" strychnine. Only after some minutes would a faint bitterness be noticed as the buffered saliva freed the base from the silicate. Atherton Seidell used the same reactions in his first preparations of vitamin B concentrates.

Through his mother, John Uri inherited pronounced literary traits, so that from his pen came with equal facility theoretical and technical papers and novels setting forth his theories of philosophy and metaphysics or picturing the people native to his beloved Kentucky. To those of his friends who asked how he found time to produce his novels while maintaining his business and his research program he had a stock answer. A page of a novel, he said, was just about

the length of an average letter, and 360 pages would constitute an average novel, so that if one could write a letter a day he might produce a book a year.

Although not wilfully so, John Uri because of his physical and phytochemical investigations frequently found himself in the minority among investigators who held to more conventional and traditional principles. He explained, or rather excused, this by calling himself an "empiricist." There are two definitions for this term. One is "One who disregards theoretical study and bases his knowledge and practice on experience alone." The one more fitting in his case is "One who deviates from the rules of science and regular practice." Through such persons do sciences and professions advance.

To ask who was the leader of the Lloyd brothers is to pose a difficult question. The pharmacist will name John Uri because of his long regular appearances before the American Pharmaceutical Association, his membership in the official family of the Association, his many scientific publications, and his active part in the creation of the first *National Formulary*. There is no doubt about his being a good man of business, but laboratory science and a creative pen were always tugging at his coat sleeves. John Uri and Curtis Gates would have been leaders in pharmaceutical science today, the one a leader in colloid chemistry and the other a famous explorer of the role of molds in the production of antibiotics.

The leadership of Lloyd Brothers could be better described as a triumvirate, each of the three brothers contributing of his talents to the affairs of the family. Some have said that Nelson Ashley through his business management made it possible for Lloyd Brothers to be and to continue to be. In the background was always the quiet, modest Curtis Gates, who probably was almost alone the spirit behind the monument to the three brothers that stands today. We have mentioned John's gift to Curtis of Wood's *Botany*. First came his herbarium of the flowering plants, trees and shrubs of the area. Next was the botanical study of drug plants and possible drug plants that might contribute to the materia medica, a Herculean task if it could ever be completed. Then followed the growing interest in mycology and the effort to find space for his collections.

John was at the same time accumulating a library of pharmacy, chemistry, medicine, and the related disciplines. It became necessary to provide a building to house the books of John Uri and the botanical collections of Curtis Gates, and thus came into being the Lloyd Library and Museum. Curtis Gates served as manager of the affairs of the library and when not traveling on one of his botanical missions kept his home there also. The collections in botany and its mycological branch became so important that they forced the erection of a second building to house the library collections. The mycological collection was eventually placed in the hands of the Smithsonian Institution in order to make it more readily available for scholarly study. This action was similar to that of the Honorable Andrew W. Mellon in providing for the erection of the National Gallery of Art in Washington to house his and other famous collections of paintings, for, as he said, "Art is national."

The Lloyd Library, devoted to pharmacy, medicine, and the allied disciplines, occupies its own home in Cincinnati. It is without doubt the most complete library of pharmaceutical literature available in North America. If it is not used nationally today it is because there was a period when pharmaceutical education was largely neglectful of anything scholarly, and too many graduates

of that era are still in practice. The library is richly endowed by bequests from the brothers, so its continuation is certain, and through the generosity and foresightedness of leaders of pharmaceutical industry a new zest for learning is growing among pharmacists, and we may hope for the time when this library will mean as much to the practitioners of America as it did to those of the generation of the Lloyds. The Lloyds of Cincinnati have their monument which should mean as much to pharmacy as Lloyds of London does to the underwriter.

The key to the growth of pharmacy as a profession and a science lies in the strength of its organization for education.

George Denton Beal, Am. J. Pharm. Ed., 6, 31 (1942)

PRIVATE DIE PROPRIETARY STAMPS

VARRO E. TYLER, JR.

The private die, proprietary medicine stamps constitute an extremely interesting group of pharmaceutical-historical objects. Because of their intriguing, classical designs and unusual historic and economic significance, they serve as valuable source materials which depict a phase of American pharmacy as it existed over a span of nearly fifty years. As such, they are neglected but potentially useful tools for the teaching of the history of the profession.

A combination of circumstances has prevented these colorful bits of paper from receiving the recognition to which they are entitled; so much so, in fact, that few pharmacists have ever seen a single one of them. This is due in part to the fact that the stamps were so avidly sought by collectors that practically all existent copies were soon absorbed into philatelic channels. Persons with little interest in this hobby were consequently deprived of the opportunity to become familiar with them. Coupled with the fact that until recently federal law prohibited the illustration of United States revenue stamps, except enlarged illustrations of certain portions of the designs for philatelic purposes, the effect was to prevent the majority of otherwise interested persons from knowing even of the existence of these stamps. Fortunately, the law preventing the illustration of revenue stamps was amended by the Act of September 2, 1958, Public Law 85-921, which in essence permits the illustration for lawful purposes of United States revenue stamps in black and white and in any size (1).

The use of imprinted seals or stamps as a means of securing governmental revenue originated in Holland in 1624 as a result of a reward offered by the States-General for the invention of a new tax (2). It was suggested that stamps be required on documents and writings having a legal function. England adopted this method of raising revenue in 1694, but Americans were first subjected to a stamp tax in 1755 when the British Parliament imposed one on the American colonies (3). Deeds, bills of lading, probate of wills, mortgages, foreign and inland exchange, power of attorney, and similar documents were subjected to the tax, and payment was indicated by application of an embossed design referred to as a stamp.

Every student of American history is familiar with the consequences of the next stamp tax imposed on the colonies ten years later in 1765. The fact that the colonists questioned the imposition of such a levy set in motion a series of events which culminated in the American Revolution. Regardless of the dim view taken by these early citizens of this type of selective tax, it apparently became adapted to American ideas and experience, since after the adoption of the Constitution, the federal government twice resorted to stamp taxes in the years prior to the Civil War. Because of the limitations of these early assessments, the majority of the people of the United States had had little experience with such taxes until, to raise sufficient revenue to meet the mounting expenses of the federal government resulting from the Civil War, the United States adopted a heavy, comprehensive system of excise taxes. The portion of the law imposing stamp duties went into effect October 1, 1862.

Items on which stamps were to be required were divided into two classes, as defined in Schedules B and C. Schedule B included written or printed legal

and business documents of all kinds, and Schedule C covered playing cards, perfumes, cosmetics, and proprietary medicines. Subsequent modifications of the act imposed duties on matches, photographs, and for a short time, preserved meats and fish (2).

Since the tax on proprietary medicines is of particular interest, it is worthwhile to quote selections from a revenue circular of the period which set forth in official language the terms of the revenue act as applied to pharmacy.

> The following articles are declared by the law as subject to stamp tax:
>
> **Proprietary Medicines and Preparations**
>
> For and upon every packet, pot, vial, or other enclosure, containing any pills, powders, tinctures, troches, lozenges, syrups, cordials, bitters, anodynes, tonics, plasters, liniments, salves, ointments, pastes, drops, waters, essences, spirits, oils, or other medicinal preparations or compositions whatsoever, sold, offered for sale, or removed for consumption and sale by any person or persons whatever, where such packet, box, etc. with its contents, does not exceed, at retail price or value, the sum of 25 cents, 1 cent.
>
> Exceeding 25 and not exceeding 50 cents, 2 cents.
> Exceeding 50 and not exceeding 75 cents, 3 cents.
> Exceeding 75 cents and not exceeding $1, 4 cents.
> Exceeding $1, for every additional 50 cents or fractional part thereof in excess of $1, 2 cents.
>
> No stamp tax is imposed upon any uncompounded medicinal drug or chemical, nor upon any medicine compounded according to the United States or other national pharmacopoeia, or of which the full and proper formula is published in any of the dispensatories now or hitherto in common use among physicians or apothecaries, or in any pharmaceutical journal now issued by any incorporated college of pharmacy, unless sold or offered for sale or advertised under some other name, form or guise than that under which they are severally denominated and laid down in such pharmacopoeias, dispensatories or journals. No stamp tax is imposed upon medicines sold to or for the use of any persons, which may be mixed and compounded for said person according to the written recipe or prescription of a physician or surgeon. But all articles whether simple or compounded by any rule, authority or formula, published or unpublished, which are put up in a style or manner similar to that of patent or proprietary medicines in general, or advertised in newspapers or by public handbills, for popular sale and use, as having a special proprietary claim to merit, or any peculiar advantage in mode or preparation, quality, use or effect, whether such claim be real or pretended, are liable to the tax.
>
> . . . Every sale of such article without the stamp will subject the party so selling to a fine of $50.
>
> . . . I desire to call your attention to the fact that all dealers in Drake's, Hostetter's, or any similar bitters or alcoholic compounds which may be used as beverages, must pay the special tax (or license) of a retail liquor dealer.
>
> Very respectfully,
> Thomas Wellwood, Assessor
> No. 14 Court Street, Brooklyn
> Oct. 16, 1867

As a means of indicating payment of the tax, the Commissioner of Internal Revenue, George Boutwell, publicly advertised for bids for revenue stamps and in August, 1862, entered into a contract with the firm of Butler and Carpenter, engravers and printers of Philadelphia. Following the death of John M. Butler in 1868, the firm became known as Joseph R. Carpenter & Co. and continued to produce all revenue stamps for the federal government until August 31, 1875, when the National Bank Note Co. of New York received the contract on a low bid. This firm, which merged with the American Bank Note Co. in 1879, produced revenue stamps until 1880, when the government itself, in the form of the Bureau of Printing and Engraving, submitted the successful bid (4). Since that time the federal government has ceased to advertise for printing contracts of this type and insofar as revenue stamps are concerned has maintained its monopoly until the present.

Considering now the private die proprietary stamps for patent medicines, scarcely had printing begun when certain manufacturers, with a sense of advertising values, began to question if they could not obtain distinctive stamps with their own design or trade mark on them. The first to propose this was apparently Dr. Herrick, manufacturer of Herrick's Pills and Plasters and Harvell's Condition Powders (5). His request was approved, and on October 15, 1862, he received a letter from Butler and Carpenter, the printers, informing him, "Your stamp will be the first private proprietary die printed; and, in this respect, you will enjoy an advantage over your equally afflicted brethern in trade."

Herrick's stamp (See Fig. 1), like others at the beginning, was about the same size as the regular two cent revenue stamp (approximately 20 x 25 mm.), but within a short time imaginations expanded, and stamps became larger and of all shapes and sizes, including giant rectangles, long narrow strips, and ten-pointed stars. Occasionally the stamp was incorporated in the design of the bottle or pill-box wrapper. Stamps became beautiful examples of the engravers' craft. Some, like that prepared for Dalley's Galvanic Horse Salve (See Fig. 1), which depicted a farm scene with a pair of horses in the foreground, enjoyed the reputation of being true works of art. Others bore extravagant names and claims for the nostrums to which they were applied. Some of the more interesting ones, in view of modern advertising regulations, include Barham's Infallible Pile Cure; Arabian Milk Cure for Consumption (See Fig. 1); T. W. Marsden's Carminative Syrup for Diarrhoea, Dysentery, and Cholera Morbus; and George Talcott's Magic Cure For Chills, Fever, Rheumatism, Neuralgia, etc. It would be interesting to determine, on the basis of modern scientific tests, the relative effectiveness of Hall's Vegetable Sicillian Hair Renewer and Mrs. S. A. Allen's Hair Restorer. Many of the stamps included dignified portraits of the bewhiskered proprietors who purveyed their remedies for the benefit of man and beast. It is interesting to note that nearly one-third of the firms who issued private die medicine stamps from 1862-1883, or their successors, were still doing business in 1957 (4).

Several advantages were to be found in the use of such private die stamps instead of the ordinary revenue stamps regularly issued by the government. In addition to the immense advertising value involved, many laymen began to consider that such a distinctive federal stamp on a package of medicine amounted to no less than the federal government's "seal of approval" on that item. Naturally, proprietary medicine manufacturers did nothing to discourage this belief. For example, the private die medicine stamp issued in 1863 for Brandreth Pills (See Fig. 1) included in the design the words "United States Certificate of Genuineness." The government apparently did not look with favor upon this practice, for when the same firm required another stamp of a new design for Allcock's Porous Plaster in 1875, it could not obtain official approval of a model bearing the same inscription (6). That the public continued to regard the private die stamps in this light is witnessed by the fact that certain companies continued to use the stamps, or slight modifications of them, long after the law requiring their use was repealed.

Since the proprietor had to bear the initial cost of engraving the die, which varied anywhere between $60 and $400, the benevolent government of that era felt that it was only fair to allow a discount or premium to him on the stamps printed from it. Consequently, discount rates varying from 5 to 10 per cent

and payable in stamps were made available to the proprietor. Since many firms used large quantities of these stamps, this amounted to an appreciable saving.

Private die stamps in 1, 2, 3, 4, 6, 8, and 12 cent denominations were used on medicines, perfumery, and cosmetics from 1862-1883. Most frequently a single stamp of the proper value was placed on each package, but sometimes lower values were used in multiple to make up a higher rate. The total quantity of documentary and proprietary revenue stamps issued from 1862 to 1883 amounted to about 7,830,000,000. Of this number nearly 5,300,000,000 were private die issues. Although this latter number includes private die stamps used on matches, perfumes, and playing cards, as well as medicines, it is safe to assume that the medicine stamps numbered about 2,700,000,000. This number, together with those stamps prepared for use on boxes of matches, constitutes the vast majority of private die issues. For this reason the entire series has become known to philatelists as "match and medicine stamps." In its commonest usage this appellation includes all private die stamps (7).

Although a tremendous number of these items were used, many are almost unobtainable today and command high prices from the numerous collectors who long ago recognized the quaintness and desirability of these bits of paper. The scarcity is due in a large measure to the fact that they were almost invariably torn when the packages were opened; that is, in much the same fashion as the stamp on a package of cigarettes.

Also, in those days few people recognized that such common articles would have any future value and discarded them without a second thought. Nevertheless, some designs are quite common today, and discoveries are still being made in old drugstore stocks. Among collectors the value of these stamps ranges from a few cents to a few hundred dollars each, depending as do all commodities, on supply and demand.

The proprietary tax on medicines imposed during the Civil War was repealed in 1883, but expenses incurred by the government during the Spanish-American War caused a similar tax measure to be promulgated. This bill was referred to as the "U.S. Revenue War Bill of 1898" and was entitled "An Act to Provide Ways and Means to Meet War Expenditures and for Other Purposes." It became effective July 1, 1898 (8).

A brief summary of this stamp act, as it applied to proprietary medicines, is as follows (9):

Articles retailing at 5 cents—1/8 cent tax
" " " 10 cents—1/4 cent tax
" " " 15 cents—3/8 cent tax
" " " 25 cents—5/8 cent tax

Articles retailing over 25 cents were subject to 5/8 cent for each 25 cents or fractional part thereof.

Articles on hand in retail stores on July 1, 1898, were subject to these rates, but dealers, who were not manufacturers, were not required to affix the stamp until the article was sold at retail. Penalty for evasion of the stamp tax was a fine of not over $500 or imprisonment not exceeding six months, or both. Pharmacists were required to file a monthly declaration stating that they had not, during that month, violated the provisions of the stamp act.

Other provisions of the act which affected pharmacists indirectly included a 2 cent tax on checks or bank drafts, a 1 cent tax on phone calls of 15 cents or over, a 1 cent tax on telegrams, an increased tobacco levy, a tax identical

FIG. 1. PRIVATE DIE PROPRIETARY MEDICINE STAMPS
(FROM THE COLLECTION OF VARRO E. TYLER, SR.)

FIG. 2. PRIVATE DIE PROPRIETARY MEDICINE STAMPS
(FROM THE COLLECTION OF VARRO E. TYLER, SR.)

with the above schedule on cosmetics and perfumery, a tax on boxes of chewing gum or its substitutes, and finally a tax of 1 cent on a pint of wine or 2 cents on containers of more than one pint capacity.

In comparing this act with the prior one enacted during the Civil War, several points are of interest. Essentially the taxes were levied on the same type of drug preparations, and it may be said that the general intent of both acts was similar. The duty assessed in this case, however, was much less than the previous tax, but the penalty for violation of this law was much greater than before.

This act appears to have been jinxed from the beginning. Only a small percentage of the necessary stamps were available by July 1 when the act took effect, and a special ruling had to be made permitting sales to go on without stamps till July 15. The pharmacist, therefore, was required to keep a record of sales of taxable goods, which had to be sworn to and stamped by July 15. Also, the amount of the tax was so small in most cases that pharmacists were generally criticized for passing on a whole cent increase in price to the consumer. Yet many pharmacists were unwilling to absorb the cost of the stamps themselves.

Endless wrangles over minor details also added to the general confusion. The government, for example, decided that new synthetic chemical agents, such as antipyrine, should be taxed as proprietary products, but that ammonia water if used for laundry instead of medicinal purposes was not taxable.

It was at this time that the government became primarily responsible for the formal establishment of Duffy's Pure Malt Whiskey as a medicine by forcing its manufacturer to pay the proprietary medicine tax (10). Up to that time the Duffy product, while asserting its virtues in various ills, made no direct pretense to be anything but a whiskey. Transfer to the patent medicine list cost it, in war taxes, more than $40,000. The company, therefore, began ingeniously and with some justification to exploit its liquor as "the only whiskey recognized by the government as medicine" and continued to advertise in this fashion until about 1905.

As may be expected, pharmacists became very unhappy with the situation in general, and journals of this period are full of their letters and articles voicing complaints and demands of revision and repeal. Because of this, or perhaps in spite of it, the act was in force for two years, being repealed in 1900.

During this short interval, sixteen medicine firms again succeeded in obtaining private die stamps (11). These stamps, although relatively few in number and less picturesque on the whole than the private die proprietaries of the period following the Civil War, form an interesting study for the historically-minded pharmacist, since nearly all of the firms or their successors are still prominent in the drug trade.

One of the most interesting stamps of this issue is that prepared for the Emerson Drug Co. of Baltimore (See Fig. 2), which features as its central design a bottle of Bromo-Seltzer (12). The label of the bottle depicted on the stamp measures 5.5 x 6.5 mm. and contains an inscription of twenty-four words, every one readable under a magnifying glass. It is generally acknowledged that this lettering ranks among the most minute ever cut on a steel die, and it is to be regretted that the name of the skillful engraver is unknown (13).

A representative collection of the private die proprietary medicine stamps

of both the Civil War and Spanish-American War periods can still be assembled at a moderate cost. Due to their attractive and colorful nature, they are suitable for use in displays intended to interest people, including students, in pharmacy. They can also serve the important function of soliciting and maintaining interest in classes devoted to pharmaceutical history, advertising, and economics.

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To be a good salesman one must possess a thorough knowledge of the products being sold. Certainly a pharmaceutically-trained individual with a general knowledge of the manufacturing and control of the products is most desirable.

Russell A. Cain, Am. J. Pharm. Ed., 7, 96 (1943)

PHARMACEUTICAL ETHICS

K. L. KAUFMAN

The subject known by this title has its roots in the same soil as all other professional ethics, and indeed, in the same good earth from which general ethics sprouted. The word "ethics" has come down to us from the Greeks, more specifically, from Aristotle who wrote on this subject at a time when his great civilization was showing unmistakable signs of moral decay. He took the word "ethos" meaning "custom" or "habit" in the singular, or "character" in the plural, and used it in a different sense; i.e., Aristotle's writings on ethics applied the word in the sense of setting standards of the right or best character or conduct. This usage has continued from his day to ours. Descriptive adjectives such as pharmaceutical, medical, or legal were not attached to the word ethics until the beginning of the nineteenth century.

The meaning and implications of the term ethics should be clarified further. Our character and our actions are *matters of choice;* they may be good or bad. The phrase "moral law" is often applied to ethics, since the word really means *right* conduct. Also, the power of a *largely unwritten law* is implied. The terms "value" (or good), and "obligation" (or duty) are other basic concepts implied in the term. Further, we cannot divorce pharmaceutical or other professional ethics from the noun itself. The term "pharmaceutical ethics" simply differs from general ethics then, in that it applies to a limited group, and is intended to guide the personal actions of the members thereof. Most written codes of ethics list in a more or less general way the proper actions and attitudes a professional person is expected to exhibit toward his fellow professionals, toward his patrons, and toward the public generally. This is true whether we are referring to pharmacists, physicians, or accountants.

It is probable that some men were seeking light on ethical questions before the beginning of written history. Of course, we cannot be certain of this, but we do find evidence that some men had reached this stage of development long ago. If we look to the earliest known laws and writings now extant, we will note certain reflections of the ethical spirit. The Egyptians planted the first seed of a monotheism. Also, they had some concepts of justice and decency. The Hermetic Books of Thoth were regarded both as ethical standards and practical medical references by the Egyptian priest-physician. These attitudes and books represent the extent of their contributions to ethics, but they were important to all mankind. Their laws and customs bear witness that the "dawn of conscience" had occurred in man.

The ancient laws of King Hammurabi (*ca.* 2200 B.C.) were devoted in part to the regulation of the practice of medicine. Since these sections dealt with charges to be rendered for certain services, they have been called "Fee Codes." However, these same parts also delineated punishments for failures in treatment and gave certain directions to be followed in some cases, e.g., laying the sick in the street, where all could see and offer advice. The "Ass Doctors" (Veterinarians) were under somewhat similar restrictions. The Mosaic law is derived largely from these early Egyptian and Babylonian-Sumerian writings. Regardless of their ethical shortcomings, these early manuscripts show that a

conscience and an interest in their fellowman existed among some, at least, of the early peoples.

The gropings of man through many millenia prepared the way for Greek philosophers—who spread the light, so to speak, and wrote the first laws of ethics. Not until this period had it been possible for individual man to develop his thoughts and to speak and to write them freely. As all of you are aware, the world owes much to the men of this age, but perhaps no groups are more indebted to them than the professional men and women of today. This is true because professional people must be characterized by a conscience and a desire to serve their fellowmen, which are not anticipated in, nor expected from, their compatriots in the trades. Part, at least, of the inspiration for the first great ethical statements on the practice of medicine came from these great writers. The Hippocratic Oath gave to medicine its highest moral inspiration, perhaps of all time. Greece, as a country, was succumbing to a life of pleasure and selfishness. The more thoughtful people could discern the trend. The effects were noted in the practice of medicine, and some individuals wanted to do something to curb the tendency. So, the Oath was written. It is the first document which bears resemblance to modern professional codes.

In more than one way, the Hippocratic Oath states the principle and gives certain examples of the necessity of using one's technical knowledge for the good. Thus, it recognizes one of the great ideals of medical practice and one equally applicable to all other health professions. This represents the first time in history that such a statement appears with respect to any profession. Other parts of the Oath are similar in principle—they reaffirm the ideal of service, and add injunctions of purity, especially against wrong actions, and of the privacy of the patients' lives.

Hippocrates also has been credited with other writings which are of an ethical nature. Chief of these is the "Law" or "Standard." This document is a series of five statements designed to distinguish qualified physicians from quacks, and to set some standards for teaching and practice. It is highly ethical in its character. Both the Oath and the Law have undergone numerous revisions in many lands. Their ethical values have given them a universal vitality and carried them down through the ages.

The other most influential man of science during the Graeco-Roman period was Claudius Galen, who lived from 131-201 A.D. Galen never prepared an Oath or Law, but wrote frequently on subjects of an ethical nature.

Ethically and scientifically, the contributions were slight throughout the Middle Ages. One of the few additions to the literature of professional ethics which came from the Christian world during the Dark Ages was the "Oath of the Faculty of Medicine" at the University of Montpellier, in France. Founded in 1141, it soon became a notable institution. Colleges of medicine, law and a course in pharmacy were established with the passing of time. Three changes stand out when the Montpellier statement is compared with the various forms of the Hippocratic Oath. They are:

1. No reference to Christ, or to the pagan deities. It is suggested that this may have been due to the presence of many Jews on this faculty.

2. Absence of reference to the use of the knife. Although surgery was not yet considered to be on the same high plane as medicine, more physicians were using it than in the days of the old Greeks, and others were completely ignoring the scalpel. Hence, the reference was unnecessary.

3. The neophyte promises to give service without fee to the needy, and never to charge anyone an unreasonable fee. This reflected a criticism which was common in those days, as it is now. The rest of the Oath could almost be considered a rephrasing of Hippocrates. The same ideals and injunctions are there, although we do find them still more generalized in content.

One notable Oath or Prayer was attributed for many years to the Jewish physician from Spain whom we generally know as Maimonides. This prayer has received much attention among students of professional ethics because it was believed that Maimonides wrote it especially for the members of his own faith. It has been proved that a German admirer wrote this Oath in the eighteenth century.

Aside from the items mentioned, the production of writings on medical ethics was relatively scanty until the beginning of the nineteenth century. Most of the leaders in medicine, when they paid any attention whatsoever to the subject, echoed the admirable ethical principles of Hippocratic writings. Isaac Judaeus in the tenth century, and Henri de Mondeville in the fourteenth, probably reflected the attitudes of the majority of the physicians of the Middle Ages. They wrote sometimes on medical ethics, but their views were distinctly hedonistic. The idealism of the Greeks was nearly swallowed up by the meticulous details of the prescribed deportment. Pertinent to the material in question was the emphasis on the ancient nobility of the profession shown in the writings of Guy de Chauliac, Paracelsus, Ambrose Paré, and Sydenham, "The English Hippocrates." All these men attempted to establish an *esprit de corps,* noble bearing, and personal honor in medical practice. The Royal College of Physicians adopted a "Statute Moralis" as early as the sixteenth century, which was designed to penalize physicians who violated the good traditions. Its effects were slight. All the authors mentioned failed to leave us any new codes or oaths. They attempted to teach by precept and writing.

While these things were happening in medical ethics, pharmacy was separating from medicine and developing its own principles of ethics. The guild system was helpful in this respect, especially as it operated in Italy. Here, the pharmacists and physicians often were placed in the same units. No doubt the latter helped to inspire the members of the newer profession to establish standards of correct conduct. However, the French and German pharmacists also took great pride in their profession and developed ethical standards without benefit of joint guild membership.

By the mid-fifteenth century, we find Saladin de Asculo suggesting that certain inquiries should be made regarding the moral character of the prospective apothecary. He does not propose a Code of Ethics as such, but his notion of the ideal pharmacist includes many qualities to be found in the later Codes. This author's emphasis is placed upon such matters as maturity, honesty, justice, and thorough mastery of one's art. In addition, the candidate must not be greedy, nor may he dispense poisons or dangerous drugs for immoral or illegal use, nor substitute inexpensive ingredients in filling prescriptions. He shall not alter a prescription without the prescriber's consent. He also is adjured to dispose of old and weakened drugs. Only "if some young and unexperienced physician picks up revolting and disgusting drugs to be compounded for some patient, then the apothecary shall not permit this to be prepared, but he shall advise the physician to prescribe more placable and better ones; lest possibly the stomach of the sick may be upset by the revolting drugs." The concluding suggestions

for the pharmacist concern the personal library he should acquire and the desirability of marriage ". . . so his youthful strength will be tamed."

Although de Asculo's suggestions deal with specific matters, it will be noted that they include at least a part of the obligations of the pharmacist toward the physicians and toward the public, and by implication, his proper relations with his colleagues. The error of losing ethical principles in a mass of specific problems was not new in professional ethics, and was not to be overcome by most groups for a very long time. The value of these written statements on good conduct easily overbalanced this shortcoming.

Toward the end of the fifteenth century, the Parisian apothecaries developed a written Oath imitating rather closely the style of the Hippocratic Oath, Christianized version. This interesting document emphasizes love, honor, and respect for parents and teachers, and the pharmacist's duty to work for the "honor, glory and adornment of medicine" (all medical fields, presumably). He further promises not to teach his profession to "idiots and ungrateful persons," and to avoid rash and greedy actions. He then names several specific instances in which he will not act immorally. The conclusion promises correct filling of prescriptions, with drugs of quality and without omissions or substitutions, and includes a repudiation of charlatans and alchemists.

The real beginning of the modern professional codes stems from a publication of Sir Thomas Percival (1740-1804). He was a distinguished practitioner of Manchester, and one well ahead of most of his colleagues so far as his interest in matters of public welfare and protection was concerned. His famous work was published in 1803 under the title *Medical Ethics*. The original consisted of 246 octavo pages, plus sixteen introductory pages. It is divided into four chapters plus a dedication, preface, and notes. The chapter titles indicate the scope of the work:

I. "Of Professional Conduct Relative to Hospital or Other Medical Charities."
II. "Of Professional Conduct in Private or General Practice."
III. "On the Conduct of Physicians towards Apothecaries."
IV. "Of Professional Duties, in Certain Cases which Require a Knowledge of Law."

Although Chapter 3 was the shortest in the book, it is intersting as the only example of a special treatment on the relationship of the physician and apothecary. To understand its significance one needs to recall that in Percival's time, the English apothecary was a minor medical practitioner. He routinely took care of most of the medical cases in the rural areas, and frequently did the same in the larger towns. He also was responsible for the preparation of most of the medicines. The apothecary of that day was better educated than the chemist or druggist, and enjoyed more privileges than the latter.

In spite of these tributes to the apothecary, the physician is then reminded to make an occasional inspection of his drugs. This was a law in London at the time, and Percival thought it a good idea. In 1803, the physician was usually a fair practical botanist, so the inspections could be meaningful.

One section discusses the matter of the extravagant profits attributed to the apothecary. Percival feels that this charge is generally unwarranted and unfair.

The next to last section is curious because it is an interdiction directed to the apothecary and not the physician. This practice was to become a habit with the

medical code makers. It probably means that the authors of these were not fully cognizant of the true and full meaning of a professional Code of Ethics. The section deals with cases in which the apothecary is requested to recommend a physician, and attempts to tell him how to make a choice. Finally, Percival tells his colleagues that they should support benevolent institutions for the widows and orphans of apothecaries.

No man in modern times has written a document destined to have so profound an effect on the lives and behavior of most professional men. The American Medical Association and similar organizations of medicine throughout the world were to acknowledge publicly their great debt to Percival. Other professions imitated the Code, with changes appropriate to their callings.

It may be instructive to consider some of the reasons for the very great influence of this work of Percival. Prior to its publication in 1803, the medical profession had tried to handle its ethical problems on the basis of the Greek tradition of good taste and personal honor. The emphasis, when any attention was given to such matters, was on the spirit and not the letter. Of course, many failed to observe the spirit, either through ignorance or lack of professional conscience. Now, the physician had a set of rules, which directed his thoughts to the letter. Of course, this was inevitable, even though not intended by Sir Percival.

The Code was written on the basis of intuition and experience, and not on ethical principle. This was to lead to serious difficulty, because there were conflicts, real or suspected, in the rules.

It might be assumed that such a fine document as *Medical Ethics* would have received prompt and full praise from the practitioners. This was not the case. It did arouse physicians all over the world to a new appreciation of their moral obligations. Even the opposition to it was, in a way, helpful. The better physicians who accepted the Code sometimes helped to cause those who acted contrary to its principles to feel outlawed. As various medical societies adopted the Code or some modification of it, it had much greater force, for these small groups usually held the power of expulsion over any offenders. (Pharmacy in the United States might take a hint from this bit of history.)

The development to date can be traced as interestingly in the history of our own country as anywhere in the world. When Percival published his book, American medicine was largely of the colonial style.

Religious leaders, governors, and educators had been prominent in medicine in early American history, as they are in all colonial lands. Some practitioners combined pharmacy and medicine to make ends meet. Still others eked out a living with different combinations of occupations. As the colonies grew older, a few men began to go abroad to study, and these usually confined themselves to medical practice upon their return.

Several colonial acts testify to the generally low state of pharmacy and medicine in these early days, e.g., the "Fee Codes" of Massachusetts (1649) and Virginia (1736). New York passed a law requiring an examination and a license to practice medicine in 1760. Shortly thereafter, the first medical college in the colonies was founded at Philadelphia in 1765. Medical societies began to be organized shortly before the Revolution. Sometimes these groups included statements of general ethical principles in their bylaws. After the appearance of Percival's work, many societies began to claim acceptance of the Code, or of its principles.

The rapid post-Revolutionary expansion of America, and the paucity of laws, attracted many unscrupulous men to the practice of pharmacy and medicine. Educational facilities developed slowly, and morals dropped in both professions.

At the first regular meeting of the American Medical Association in 1847, requirements for minimal training and the adoption of a Code of Ethics were principal items on the agenda. Members were supposed to subscribe to the Code, and local societies desiring representation were required to consider it binding upon their members, too. The first AMA Code acknowledged its indebtedness to Percival, but it was shorter, and consisted of only three chapters. Their titles were "I. Of the Duties of Physicians to their Patients and of the Obligation of Patients to their Physicians. II. Of the Duties of Physicians to each other, and to the Profession at Large. III. Of the Duties of the Profession to the Public and of the Obligations of the Public to the Profession."

We have time only to refer briefly to other professional codes. Their order of adoption is interesting, because it suggests the period at which the leaders of a profession saw a need for crystallizing their ideals into written forms. It also might suggest that the formal act of adoption does not insure complete acceptance of the principle by all members of a profession.

About 300 codes of American groups are now in existence. They run the gamut of activities from accounting to hairdressing, from hardwaremen to warehousemen. Three of the health service professions were the leaders in adopting national codes of ethics in this country. Medicine was first, followed by pharmacy, then by veterinary medicine. It may be noted that the great majority of national organizations developed their codes during and following World War I. A similar but smaller wave of adoptions and revisions has followed World War II.

One of the notable tendencies in the professions in the last decade or two has been that of reducing the length of the written Codes of Ethics. Among the established professions in this country, only the Canons of the American Bar Association remain longer than three or four printed pages. This trend followed the much earlier tendency to recognize that a professional code should govern only the actions of the group for which it is written. No longer do we find the AMA emphasizing the obligations of the patients and of the general public to the profession as it did in 1847.

These trends indicate a continuing maturation of the professions. They show a growing recognition that professional ethics are based on the same ideal principles regardless of the professional group. More importantly, they indicate the recognition that good professional ethics is a reflection of a proper attitude of mind. As Emerson said, "What you are speaks so loud I cannot hear what you say." No code, regardless of its length or content, can cover all the specific cases with which the pharmacist or other professional person may be confronted. It is, and can be, only a suggestion of things which are largely inexpressible. The professional code merely attempts to express principles known to the best types of professional conscience.

I would point out . . . that an important part of knowledge is ethics. There is nothing in an education fact which causes the one who has it to use it for the benefits of mankind.

Walter D. Cocking, Am. J. Pharm. Ed., 4, 26 (1940)

DAVID STEWART, M.D.
FIRST AMERICAN PROFESSOR OF PHARMACY*
[1813-1899]

GEORGE E. OSBORNE

EARLY YEARS
[1813-1840]

Dr. David Stewart, the fourth of his name and profession, was born on St. Valentine's Day, February 14, 1813, in the small town of Port Penn, Delaware. Today, his granddaughter, Mrs. Ruth Stewart Wilson, recalls,

> I doubt if the population of Port Penn ever reached five hundred persons and our family was the only Stewarts there. In fact, many years ago, as far away as Wilmington, when I was introduced to an elderly person, she remarked, '—Stewart—why certainly I've known you for two hundred years.' (1)

This estimate of time is not at all exaggerated, for the first Dr. David Stewart acquired the property on which he built the Stewart homestead in Port Penn in 1730. There followed five generations of Dr. David Stewarts, and the patrilineal name has been carried on to the seventh generation, although the last two of the line have turned away from the practice of medicine (2).

David Stewart's early years were spent in Port Penn and in New Castle, Delaware; he was educated at the New Castle Academy. At about the age of eighteen, he was sent to Baltimore to study pharmacy and chemistry, and within a few years after his arrival in that city, he had become very active in civic affairs, serving as a member of the Baltimore City Council (1835-1837), School Commissioner of Baltimore (1836), Ruling Elder of the First Presbyterian Church, Baltimore (from 1838), and Member of the State Senate (1840) (3). There is little doubt that his political career was advanced considerably by his first marriage, on December 10, 1835, to Henrietta Marie Earle, daughter of Judge Earle of Centerville, Maryland. (Again Mrs. Wilson (4): "The people from the Eastern Shore are 'snootier' than anyone that ever came out of Boston, but if one had the right connections, he was 'in'!") From this marriage two children issued: a daughter, Henrietta, was born in 1836; the second child, a son, David, died in infancy, to be followed in death soon afterwards by his mother.

That David Stewart practiced pharmacy during this period of political activity is evidenced by his use of the title "Chemist and Pharmaceutist in Baltimore" following his signature to articles published in the *Maryland Medical and Surgical Journal* (1839, 1840) and by a note in the family records reading:

> It must have been early in '39 that [David] opened a 2nd store on Charles St. at Lexington (Street) designing to establish [his brother] James there 'in partnership' at first. This arrangement continued until the summer or early fall of '40 when James preferring the cor. of Han & Camden, they exchanged . . . (5)

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*Presented to a joint session of the Section on Historical Pharmacy of the A.Ph.A. and the American Institute of the History of Pharmacy as a part of a symposium honoring the founding members of the A.Ph.A., Philadelphia, August, 1952.

FOUNDER OF THE MARYLAND COLLEGE OF PHARMACY [6, 7]

[1840-1844]

Both physicians and pharmacists took an active part in the founding of the Maryland College of Pharmacy, which was projected at the annual meeting of the Medical and Chirurgical Faculty of Maryland* in Baltimore, June 1-3, 1840. At that meeting of physicians, a committee was appointed to plan, conjointly with a number of pharmacists, for the organization and report at the next meeting.

Within a week, on June 8, 1840, such a committee met. It consisted of Drs. Samuel G. Baker, William E. A. Aikin, and William Riley; the pharmaceutical interests were represented by Messrs. John Hill, George W. Andrews, Thomas G. MacKenzie, David Stewart (then twenty-seven years old), H. B. Atkinson, J. W. W. Gordon, Jonathan Chapman, and Robert H. Coleman. After a considerable amount of discussion, it was decided "to appoint a committee of five apothecaries to report the best plan for a College of Pharmacy in the City of Baltimore." Two weeks later, the report was read, wherein the committee recommended "the calling of a general meeting of all regularly educated apothecaries** of the city, in order that all might have an opportunity to express their views in reference to the project." The meeting was scheduled for July 6, 1840, at which time a further committee was appointed to draft a constitution and bylaws. Finally, on July 20, 1840, a meeting of organization was held, and it was then that the Maryland College of Pharmacy began its career.

Among the officers provided for by the constitution were members of a Board of Examiners, who were to examine orally all applicants for membership not receiving the unanimous vote of the Board of Trustees, and who were to investigate the quality of medicines such applicants were in the habit of dispensing. David Stewart was elected to this board. His name appears also in the Act of Incorporation of the Maryland College of Pharmacy, dated January 27, 1841.

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*This same faculty was responsible for the founding of the Maryland College of Medicine in 1806 (23).

**Up to this period, the training of pharmacists in Maryland had been entirely practical. It was altogether confined to an apprenticeship in some drugstore, and no attempt was made to go into the theory of the subject, or to give literary polish to the instruction. The Philadelphia College of Pharmacy had been in existence since 1821, and the New York College since 1829, and there may have been in Maryland some, especially in Baltimore, who had received the benefits of training in these schools (6).

It is recorded by Mr. William S. Thompson, of Baltimore, who began his career as apprentice about the time mentioned, and who was one of the first 3 graduates of the college, that, previous to this period, it had been quite the custom among physicians to compound at their offices such medicines as they desired their patients to have, the labor being frequently assigned to a more or less inexperienced student of medicine, then usually pursuing a course of reading at physicians' offices. Prescriptions were then not so frequently prepared by the apothecary, and the latter was more a vendor of crude drugs, such pharmaceutical preparations as were then in common use by the laity, numerous quack nostrums and a variety of other articles in no sense pharmaceutical, such as glass, paints, dyestuffs, etc. Gradually, however, as the number of medicines increased, and as their preparation and compounding required more time, a more thorough knowledge of their characteristics and constituents, and hence greater skill, the physician, at least in the larger cities, laid aside his mortar and pestle and abandoned this work to the apothecary, confining himself to the practice of medicine. Apothecaries' shops with their apprentices then became more numerous, and soon the general desire to afford the latter an opportunity for receiving systematic instruction in the sciences relating to their calling led to the establishment of colleges of pharmacy (7).

The first course of lectures at the college began the first week in November, 1841, and ended the latter part of February, 1842; the lectures were delivered by members of the college, and David Stewart lectured on chemistry. Neither officers nor lecturers received compensation for their services; the income from the members' and students' fees applied solely to the purpose of sustaining the college.

On October 3, 1841, the Board of Trustees resolved that

> Whereas the constitution of this college requires attendance upon but one course of lectures for graduation, the course of lectures before this college be delivered hereafter biennially and that the board of trustees be requested to qualify themselves to deliver the lectures of the next course during the season of 1843-'44.

This action was found necessary because of the small number of students likely to attend an annual course; and even then, at the close of the second course (in 1844), there was only one graduate.

FIRST PROFESSOR OF PHARMACY IN THE UNITED STATES [1844-1846]

The limited attendance of students and the heavy expense were telling on the resources of the college, and in the spring of 1844, a committee consisting of Messrs. Reese, Graham, and Stewart was appointed to make an arrangement with the Faculty of Physic of the University of Maryland whereby the students of medicine were to have the benefits of the lectures on pharmacy of the College of Pharmacy, in return for which the students of pharmacy were to enjoy the privilege of attending the lectures on chemistry by Dr. W. E. A. Aikin, Dean of the Faculty of Physic (6).

The selection of David Stewart to serve on this committee was politic, in view of two facts. First, the medical students had addressed themselves directly to him, asking permission to attend his lectures on pharmacy;* second, he was at the time preparing himself to take the degree of Doctor of Medicine at the University. Having always believed that the deaths of his son and wife were due to inadequate medical care, he determined to make a study of medicine (4). He carried out that determination, presenting for his inaugural dissertation a handwritten thesis of twenty-four pages on "Chronic Pneumonia." He received the M.D. degree in 1844, at the age of thirty-one, at about the same season during which he was helping complete the negotiations between the college of pharmacy and the university.

In view of the unsatisfactory method of delivery of lectures at previous sessions of the College of Pharmacy (i.e., each lecturer had been assigned a certain number of pages in the text to be covered by him in his allotted time), it was decided to choose a Professor of Pharmacy, and Dr. David Stewart was unanimously elected to this professorship. The chair of pharmacy so created was, on April 30, 1844, designated fully as "Theory and Practice of Pharmacy." Thus, the Maryland College of Pharmacy has the honor of being the first

*"Prof. David Stewart, the first incumbent of a separate and distinct chair of pharmacy in the United States, delivered a course of lectures in the halls of the University. I have in my possession a letter addressed to Professor Stewart at that time by the medical students, asking that they be permitted to attend his lectures on pharmacy, and it is needless to say that such permission was cheerfully granted. During that winter medical and pharmaceutical students jointly attended Professor Stewart's lectures delivered in Chemical Hall, thus marking the first close intercourse between the classes of allied professions." Charles Caspari, Jr., address at mass meeting of all alumni, University of Maryland, January 22, 1907 (8).

institution in the country to establish an independent chair of pharmacy, and David Stewart was the first man to occupy that chair.*

The emoluments for the labor were to be such a sum as might be derived from the sale of tickets to the course, but the labors of the professor were never pecuniarily remunerative, nor was the number of students sufficiently large to justify the attending effort and expense (7). Further, Dr. Stewart had, on January 8, 1845, married Emma P. Littlefield, a native of Maine, and a son, David (the fifth), was born in the same year. These added responsibilities in time and money brought about his resignation from the professorship on April 28, 1846. In 1847, the lectures of the college were suspended altogether.

Dr. David Stewart's continued interest in pharmacy was expressed in his affiliations with the Medical and Chirurgical Faculty of Maryland, a society which he served in many official positions. To him the medical and pharmaceutical professions in Maryland owe the introduction of many valuable remedial agents, including collodion, cod liver oil, glycerine, gutta percha, etc.

Through a committee of which he was chairman, this faculty has the distinction of being the first society in America (June 8, 1855) to propose the substitution of the metric system of weights and measures for those then in use (9). This interesting facet of Dr. Stewart's perspicacity came to light five years after his proposal when, upon reading an article on the subject in the *American Journal of Pharmacy* (Philadelphia), he was prompted to write a letter, part of which is quoted here as it appeared in the *Journal and Transactions of the Maryland College of Pharmacy*: (10)

February 18, 1860

Gentlemen:

Will you allow me to reclaim for Maryland the honor of proposing that decimal weights and measures be substituted for the miserable farrago that has so long disgraced our National Pharmacopoeia? In the last number of the Phil. Jour. of Pharmacy there is an article upon the subject, and as it is the only article that I have seen in print, others are *apparently* before us in this important step—but Prof. Proctor will remember that five years ago, I wrote to him upon the subject—and he will also remember that in his answer to my letter he said that it was impracticable—"because it required all of the absolute power and inflexible will of Napoleon to change the weight of France." My opinion was not changed by this argument, being based on the following arguments that are recorded as a part of my annual report as chairman of the standing committee on the U.S. Pharmacopoeia, that was read by me before the Maryland State Med. and Chir. Faculty at their annual meeting on June 8, 1855.

FIRST.—Every one will admit that the proposed change is desirable.

2ND.—It is not impossible—but has been accomplished; *a fortiori*—it is more easily repeated on a smaller scale.

3RD.—It has been repeated on even a larger scale, as decimal weights and measures are now the language of science the world over.

4TH.—The troy weights of our U.S.P. are not even the weights used in dispensing medicines, nor the weights of other commercial transactions.

5TH.—It would be less difficult to change the weights of the Pharmacopoeia than those of commerce, especially as the decimal weights are already used by every scientific apothecary.

6TH.—It is extremely difficult, if not impossible, to obtain accurate troy weights. (I have now five setts of troy weights here in my laboratory.**)

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*David Stewart's appointment antedates that of Wm. Proctor, Jr., at Philadelphia by two years; however, it must be recognized that Proctor was a pharmacist teaching pharmacists, while Stewart held the M.D. degree, and his classes were thrown open to students of both pharmacy and medicine.

**Laboratory of St. John's College, Annapolis, Maryland.

1st. A sett of Palladium weights made from wire by Chamberlain of Boston, that decimate well—they cost me five dollars, although the largest one is only five grains—they differ from the standard U.S. grain weights made by order of Congress, and deposited in this laboratory by our Legislature as the standard weights to regulate all others by, viz.: the palladium weights are 340 millegrammes heavier in comparing only ten grains of each.

2nd. I had a complete sett of brass grain weights made by an expert in New York who was recommended to me while there as the man at the head of his profession as philosophical instrument maker—he made them to order, and I paid him $4.50. They are heavier than above standard 235 millegr. in ten grains, and not only so—they do not agree together.

3rd. A sett of what are called box weight, such as the apothecaries use, are heavier 150 millegrammes in ten grains.

4th. A sett of laboratory brass weights such as are sold with balances for analysis in mahogany cases—these are 120 millegr. heavier than standard, using 10 grains of each.

5th. Glass weights that I made some 10 years since, out of homeopathic bottles—these are the best sort of weights, and agree with the palladium.

6th. The standard grain weights of the U.S. presented to the State of Maryland as above.

My seventh proposition is that the French decimal weights are usually extremely accurate, and may be had in any part of the civilized world at a cheaper rate than any other accurate weights.

8TH. The decimal currency now in use in the U.S. indicates a corresponding decimal system of weights.

And 9TH. Since the above paper was read—as the report of committee in 1855 on the U.S.P., to the State Faculty of Md.,—the whole civilized world has been aroused to the importance of the decimal system of weights and currency, and that which Professor Proctor said was impracticable except by absolute force has been already accomplished to some extent by the spontaneous act of the people, and is now seriously entertained as a proposition emanating from Philadelphia in the American Journal of Pharmacy!!

FOUNDER OF THE MARYLAND MEDICAL INSTITUTE
(1847-1850)

Never one to be satisfied with a routine of narrow interests, Dr. David Stewart, shortly after resigning his professorship of pharmacy in the Maryland College of Pharmacy, busied himself with a group of other medical practitioners, Drs. D. Frick, E. W. Theobald, and C. Johnston, who were setting up a medical preparatory school. Their plans materialized in 1847, when the Maryland Medical Institute was established at the corner of Fayette Street and Elbow Alley in Baltimore. Dr. Stewart served as one of the corps of lecturers during its brief existence (11). Described as a preparatory school of high rank, the project was, nevertheless, short-lived, lasting at the most only five years. By 1853, the Baltimore city directory no longer listed the institute (12).

INSPECTOR OF DRUGS, PORT OF BALTIMORE
(1850-1853)

About the year 1850, in recognition of Dr. David Stewart's unusual combination of chemical, pharmaceutical, and medical abilities, the government appointed the thirty-seven-year-old scientist to the post of Inspector of Drugs for the Port of Baltimore; "and," as the family record puts it, "his time was well occupied." It was while serving in this office that he became acutely aware of the need for legal standards of assay for drugs. He made some studies in that direction, and there are claims that he was the first man in Maryland to separate the total alkaloids from opium and cinchona (5).

David Stewart put his knowledge of analytical procedure to excellent use

in his reports to the Medical and Chirurgical Faculty, and he repeatedly pleaded for the adoption of assays for the drugs of the pharmacopeia. His letter of February 18, 1860, previously quoted in part, continues (10):

> In the paper referred to (of 1855) I carried out the idea with regard to Tinctures—and other preparations—proposing that all vegetable powders, extracts, &c., that are hereafter introduced should be either saccharated or concentrated so that ten parts may represent one part of the active element in its *official* or *compound* form. Using "Dover's powder" as the illustration, ten parts of which always represent one part of opium. But opium is of extremely uncertain and variable strength—consequently all of the formulae of the *present* pharmacopoeia based upon it are of uncertain strength—some laudanum sold within 100 miles of Philadelphia and Baltimore is used by order of a physician in doses of a teaspoonful for an infant!! And again we hear of one drop as a fatal dose. I will venture to say that there are no two preparations of this powerful drug either in Philadelphia or any other city that contain the same per ct. of morphia, although made by the formula of the last U.S.P.
>
> Suppose that the officers of the U.S. Mint were equally careless, and used the gold and silver ore without first assaying—or worse still—suppose "the U.S." were to pass a law authorizing the coinage of native gold and silver as a legal official tender without determining its per ct. of alloy. Among the few numbers of the New York Journal of Pharmacy, will be found one that contains a paper of mine on Tincture of Opium of *definite strength* and a formula for the pharmacopoeia of 1860, by which it may be made out of opium containing either 4, 8 or 12 per ct., (or any other) of morphia—always of exactly the same strength, and instead of requiring one or two weeks, I can make it by that formula in one or two hours, (and have done it).
>
> As pharmacy is becoming more of a science, our formulae should be more perfect. They should not be adapted to the ignorant, nor tempt the cupidity of the fraudulent and self-deceived apothecary who buys cheap opium—in order that he may satisfy the demands of his conscience when he assures the purchaser that the full proportion of the U.S.P. was employed in making the tincture; and upon the same principle calls a part of his store New York, so that he may conscientiously say that certain articles were just received from New York. This article "on Tr. Opii sine Codeia," I read before the state faculty in my annual report about 6 or 8 years ago—but the following suggestion has not been made as yet by any one I believe.
>
> The alcohol that is prescribed by our National Pharmacopoeia should be free from fousel oil, as in the case of opium so in this case, the article should be of known quality. I do not refer merely to strength but purity. Here again I would use the *a fortiori* argument of the mint—"Is not the life more than the meat" and the body more than gold? The wine bibber pays $5, or $10, and even $20 per gallon for the wine and brandy that are warranted pure and free from fousel oil—but when the same man is sick—he is dosed with some tincture that contains the latent poison in abundance; although he pays 12 or 25 cents per oz., that is at the rate of $16 or $32 per gallon; yet the apothecary gives him common alcohol in this tincture that costs only 25 cents per gallon diluted. While the purest deodorized absolute alcohol should always be used, although it costs one dollar per gallon, and make the proof, or tincture spirit 50 cents per gallon. *If the pharmacopoeia so ordered expressly.*
>
> I do not believe in the absurd dogmas of homeopathy—but I do believe that a few drops of a tincture made in accordance with the U.S.P., may be as far inferior to some quack's elixir of opium—as the miserable farrago frequently sold as wine is inferior to the genuine Tokay. And I have the testimony of one of the most distinguished therapeutists in Philadelphia, that one of his patients could not use the tincture of the U.S.P., but the elixir above referred to, afforded the desired relief. In both of these preparations of opium no doubt the same dose of morphia was used—but there was—or was not—some infinitessimal dose of fousel oil or something else, (codeia for instance), and so with regard to the old wine referred to—there is an imponderable something that compels the connoiseur to prefer it to common wine.
>
> The description for the official glycerine is another matter that is becoming more important, as it is used more generally. And I wish to record here the

fact that the first glycerine that was used in Maryland was brought to Baltimore by special order of the above State Chirurgical Faculty, and distributed gratuitously at the expense of the Faculty among many of its members. This also was due to a report of the Standing Committee of three, only one of whom as such survives the decade that terminates the Pharmacopoeia of 1850.

DAVID STEWART, M.D.
Prof. Chem., &c., St. John's College,
Annapolis, Md.

FOUNDER OF THE AMERICAN PHARMACEUTICAL ASSOCIATION

(1851-1852)

Inasmuch as the "consideration of the subject of Standards for the guidance of the special examiners of Drugs, Medicines, Ect., at the several chief Ports of Entry" was the purpose of the Convention of Pharmaceutists and Druggists held in the city of New York, October 15, 1851, it is not surprising to find among the minutes a reference to David Stewart, who was at the time the Inspector of Drugs for the Port of Baltimore. Although delegates to the meetings from the Maryland College of Pharmacy had been appointed, none were in attendance; but a letter from Dr. Stewart setting forth his views on the matter was read (13).

When the National Pharmaceutical Convention was held on October 6 and 7 of the following year, 1852, David Stewart was there; along with George W. Andrews, he represented the Maryland College of Pharmacy. Dr. Stewart was very active at this first meeting. He served on a number of committees. Drawing on his experience as Inspector of Drugs for the Port of Baltimore, he posed several questions and proposed several resolutions, all resulting in lengthy debate and discussion, the final outcome of which was a resolution "that the whole subject of the inspection of drugs shall be referred to a Committee . . ." He was appointed to that committee.

It was David Stewart who first officially used the title "The American Pharmaceutical Association" in his motion that on the adjournment of the National Pharmaceutical Convention, it meet in Boston *as the American Pharmaceutical Association* on the fourth Wednesday (24th) of August, 1853 (14).

After his rather brilliant participation in the founding of the association in Philadelphia, David Stewart never again attended a convention meeting of the A.Ph.A. This apparent disinterest may be explained by the fact that in May, 1853, Dr. Aikin, his former associate at the University of Maryland, was appointed inspector of drugs to succeed him.

The name of David Stewart, M.D., Baltimore, continued on the Roll of Members of the association for some thirteen years. In 1860, he was placed on the suspended list because of "contributions due from 1855—5 years" (15), but these arrears were apparently settled, for the next issue of the *Proceedings* again recognized him as a full member. The name was finally stricken from the roll in 1865 for "non-payment of dues for over three years"; there was also the remark, "address now unknown" (16). He had by this time returned to his home in Delaware.

CHEMIST TO THE STATE AGRICULTURAL SOCIETY, PROFESSOR OF CHEMISTRY AND NATURAL PHILOSOPHY, AND VICE-PRESIDENT, ST. JOHN'S COLLEGE (ANNAPOLIS) (1855-1862)

In 1855, with the Civil War threatening the nation, Dr. David Stewart moved his family to Annapolis, Maryland,* where he had accepted the professorship of chemistry and natural philosophy on the faculty of famous old St. John's College. In his laboratories there he developed further his analytical techniques, acting as chemist to the State Agricultural Society. A letter from Baltimore, addressed to him at St. John's, dated July 23, 1856, reads,

> a package of three samples of Bark are being shipped by Adams Express, of which you will please furnish us with such analysis as you usually give for us . . . for our government.
>
> Jas. J. Fisher & Sons.

He likewise continued his investigations of a theoretical nature. In an essay "On Butyric Acid," published in the *Journal and Transactions of the Maryland College of Pharmacy* (17), there is an unusually interesting note, wherein Dr. Stewart claims priority in the discovery of the acid:

> It is a singular coincidence that the French-man, M. Isidore Pierre, should publish his paper in Comptes Rendus, on August 22d, 1859, page 286, while mine was in Washington on Saturday, 5 March, 1859; but it is still more remarkable that he should say in his paper that he commenced his investigations *in March, "and afterward"* discovered the Butyric Acid in the dung heap. It is still more difficult to acount for the fact that he seems entirely to overlook the *other* sources of sugar in the manure, and attributed the butyric acid to some beets that were accidentally present, or rather to the sugar they contained. I have no doubt that the illness produced by cheese (that is improperly made), is due to the formation of Butyric acid in *many instances*. D.S.

David Stewart's seven years at St. John's covered a stormy period in Maryland history, when as a border state, the people had to decide whether to remain loyal to the Union or join the states to the South. Maryland remained in the Union, and during the war, St. John's College became a hospital for Union soldiers. On one occasion, Governor Llyons called upon Dr. Stewart to support him in reviewing the Federal troops drawn up on the college green. He was then Acting President of St. John's; the President had left the college to look after some personal property in Virginia. It required no little nerve to carry out the governor's request, as the trustees and most of the professors, students, and the community were in sympathy with the South (5).

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*When this move was made, in haste, one of the family's most interesting historical trinkets, the key to Stirling Castle, was lost. Sir John Stewart had sailed on the ship *Conaunt* from Edinburgh, Scotland, by way of the West Indies, landing in New Amsterdam (New York) in 1699. His father, Sir James of Stirling, Scotland, had entrusted to his care the key to the family castle. Sir James was a wealthy man, and it was not necessary for his son to seek employment in this country. Sir John married here, however, and remained to become the grandfather of the first David Stewart. The key to the castle was handed down, David to David, until the incident of this move. It was packed in a small trunk, and the movers were told to be especially careful of that trunk. The trunk disappeared. Dr. Stewart considered that the movers, alerted by his warning, thought that the trunk contained valuables and just took it. Many valuable letters and records were unfortunately destroyed after Dr. Stewart's death, when the old home in Port Penn was sold. Among them was a deposition from a Capt. J. J. Roland, who came over on the same ship with Sir John in 1699, taking his oath as to the authenticity of the lands in Scotland and the fact that they reverted to the Crown, signed in August, 1752 (2, 21).

In view of the divided loyalties and the limitations placed on the functioning of the college as a teaching institution during wartime, the Board of Trustees, on September 5, 1861, passed the resolution (18):

> That in consequence of the distracted condition of the country, the office of Principal of this Institution shall for the present remain vacant [the President had by this time resigned], and for the purpose of efficiently reorganizing it at a more propitious period, and meanwhile of devoting a portion of the funds of the College to the payment of exisiting debts, the office of Vice-Principal and of the several Professorships be now vacated.

St. John's remained in session during the ensuing academic year, and David Stewart continued there, returning to Port Penn probably in June of 1862. At any rate, the transfer of his membership from the First Presbyterian Church of Annapolis (where he was also a Ruling Elder) to that of Port Penn was completed on July 2, 1862. He was a deeply religious man and had contributed generously of his services in the Presbyterian Churches of Baltimore and Annapolis; it is most probable that he initiated the transfer of his church membership immediately on his arrival home (19).

LATER YEARS
[1862-1899]

David Stewart was forty-nine years old when he took his family, now increased to six children (a seventh was born later), back to Delaware to occupy the Stewart homestead and live the life of a gentleman. During Dr. Stewart's tenure, Stewart House became a house of culture in Port Penn; he and his sister (Mary) frequently conversed in Latin. In later years, visitors at the house were always greeted most cordially, but Dr. Stewart would eventually retire with a book to his easy chair and would take no part in the conversation unless directly questioned (19).

He practiced medicine in Port Penn, New Castle, and the surrounding communities; he joined the Delaware State Medical Society in 1879, giving his address as New Castle (20). But he seemed to prefer his own acres: he enjoyed his bees, his fruit trees (pears and grapes in particular), and his pigeons.

> Grandfather used to take honey from the hives with only an old straw hat having mosquito netting hanging from it. David [the sixth] said he kept the same old hat for years—he never had any other protection. The bees would crawl on his hands and sting him until they were rosy pink but it never phased Grandpa. (21)

He continued his laboratory experiments in the kitchen of Stewart House, much to the distress of the cook. She frequently complained to Mrs. Stewart that the doctor had let batches of soap—or even of pitch—boil over on her stove! At one time, so the story goes, he melted down a solid gold stick pin to secure a supply of that metal for an experiment (4).

Dr. Stewart used a little room at the head of the stairs for his apothecary shop where he made his pills and concocted his medicines. It has been said by members of the family that he could mix up the worst concoctions that anyone could conceive of.

> David [the sixth] has taken Grandpa's concoction for worms (more than once), which made him nauseated for days and even at this late date (at 71) it makes him squeamish to recall it. (21)

The old gentleman sat and wrote a great deal, chiefly on the subjects of politics and religion. He was one of the oldest subscribers to the *New York*

Observer (later *The Presbyterian* and now called *Presbyterian Life*) and contributed to it frequently under the nom de plume of "The Augustus Letter."* For his writing he used a chair with a single broad arm and sat in either end of the parlour or the sitting room (21). It is not difficult to picture him at the age of eighty-three, three years before he died, penning this letter to his son:**

Port Penn, Del
19 Sept 96

My dear Son David

I suppose Rufus with *both* the girls will be with us on next Saturday—I have rec. from enclosed firm a satisfactory supply among other—"Beech Wood Creosote" —but the price of castor oil and alcohol exceed all my experience. $1.30 for c. oil is nearly double and the price of a bus. of corn *was* the price of a gal. of alcohol! —I failed to order the magnesia and aconite root—but I have enough to last for a month and during the interim you may visit Phil. and get me a supply. I enclose an order therefor—*in that accnt.* I have expended 3i cocaine in *making* a remedy for toothache and the *continued* demand of those who have tried it seems to prove its value—I gave Dale the formula.—

My views as to currency: Tariff: Tax: and the interest on money make me hesitate to vote for either candidate—our senators and reps *must* discuss a vote on such matters *before* the Prest. can use his opinion and they may then overrule! Nevertheless the furor and amt. of essays would indicate that he decides.

There is but one *sure* and *rational* basis for currency and the medium is of no account—whether nickel: copper: paper: silver: or gold—except as to the *cash* —what is most necessary is the *uniform* stability and my plan *insures* it both as to tax: tariff, interest and currency. The absurd attempts to protect our merchants and manufacs. by tariff while double or treble interest is allowed on money "is not good nonsense"—it is demonstrated that 3 per ct has never been exceeded in the *product* of capital (on an average of 20 years) in the U.S.!! and that 12 ships—half being equipped in England of the same company—and half in the U.S.—*must* inevitably belong to the *six* English at the end of 10 years because the rate of interest *there* never exceeds 3 per ct of the *money*. Aristocracy here are thus multiplying at the expense of the wage earner and manufactures and agriculturist. The millionaires "use" the Tariff and currency every 7 years to deplete the millions.

If the present modes of taxation were changed and the tariff abolished substituting therefor an "income tax" to support the govt. and 3 per ct was made the *limit* of interest the uniform success of trade and manufacture would arrest the multiplication of the millionaires and save our republic. Free suffrage now is becoming our ruin as votes are bought and our legislatures retire upon bribes—serving "money kings" If you will read a column in *last* N. Y. Observer you will appreciate the vital importance. See pa 451. It is well *to be* posted.

If you have a chance—get a ¼ inch chisel for me I use it in glazing and as a screw driver (someone has both mine)

Affy yr father
D. STEWART

Preserve this letter for David as he may live to see my prediction fulfilled as I live to see the substitute for stage coach: tallow candles and telephone etc etc
I spent one day in bed without a morsel of food but am now peripatetic.

On finishing a letter, Dr. Stewart would rise from his chair, walk to the closet under the stairs, take off his skull cap (which he always wore), pick up his wig and put it on, then his broad brimmed hat and linen duster. Then he would walk over to the front door, by which was a "cubby-hole" or very narrow closet, reach in and get his cane and start off to the post office about a square down the street. This procedure was followed every time—no variations (21). While making his way through the town, the old doctor would go out of his way to recognize people and greet them with a kindly word. He was, however,

*The obituary (22) says he wrote under the title "Sigma."

**As directed by his grandfather in the postscript, this letter is in the possession of David (the sixth); he graciously lent it for our inspection. Even at the advanced age of eighty-four, the handwriting was steady, distinct, and forceful; many of the words ended with a broadened, straight, downward stroke of the pen. Punctuation, abbreviation, and underlining (*shown here in italics*) have been reproduced as faithfully as possible. G.E.O.

most formal in his manner, bowing and removing his hat whenever he met a lady on the street (19).

On a Sabbath morning, September 3, 1899, Dr. David Stewart, in his eighty-seventh year, died quietly at his residence in Port Penn. His obituary was concerned chiefly with his connections with the Presbyterian Churches in Baltimore, Annapolis, and Port Penn. On September 29, 1899, at the session meeting of the Port Penn church, the Reverend O. A. Gillingham and Mr. J. B. Vandegrift presented a resolution praising his work in the church and commending his soul to his Heavenly Father (19).

> He was a dear and very good man, but I think it would set him spinning in his grave to have any of it repeated . . . Dr. Gillingham who conducted the [funeral] service was speaking to close friends and relatives. The final lines [are these]:
>
> 'Dr. Stewart belonged to the olden school in manner—stern, yet gentle as a woman and courteous as a Chesterfield. He was a brilliant conversationalist with whom no one ever conversed without profit and his tongue was always clean. But Dr. Stewart is not dead; he has left a godly and honoured family to perpetuate his name, and by his good works he "being dead yet speaketh." Like a shock of corn he has come to his grave in a full age.' (22)

Of his five sons, David (the fifth) was a physician, Thomas Dale was a pharmacist, Kensey Johns was a Presbyterian minister, and Rufus and James were businessmen. Two grandsons, each named Thomas Dale Stewart, have shown some influence of their inheritance: Thomas Dale Stewart, Ph.D., is Professor of Chemistry at the University of California (Berkeley), and Thomas Dale Stewart, M.D., is Curator of the Anthropology Division of the Smithsonian Institution in Washington, D.C. A third grandson, Henry VanDyke Stewart, son of David the fifth, in high school and college majored in chemistry and bacteriology. Public health work occupied his time until he took his medical degree and began the practice of medicine at the age of fifty.

David Stewart (the seventh) early developed leanings toward chemistry, and today he is a chemical engineer, Chief Technician for the Sinclair Oil Refinery at Marcus Hook, Pennsylvania (4). He is the last of a long line of David Stewarts, most conspicuous of whom was perhaps David the fourth, chemist, pharmacist, physician, educator, founder of the American Pharmaceutical Association, an advanced thinker and a pioneering exponent of the scientific practice of pharmacy in America.

ADDENDUM
Bibliography of Scientific Publications by David Stewart

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(14) *Proceedings of the National Pharmaceutical Convention,* Philadelphia (1852), pp. 5, 7, 11, 14-18, 20.

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(19) Communicated through personal correspondence with Rev. John R. McClain, Delaware City, Delaware, dated June 25, 1952.

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A CLASSIFICATION OF THE CHEMICAL ELEMENTS ACCORDING TO THE DERIVATION OF THEIR NAMES

ARTHUR E. JAMES

During the academic year 1955-56 the author of this paper was on leave of absence from Temple University School of Pharmacy in order to serve, under the Fulbright Act, as Lecturer in Chemistry at the University of Peshawar in Pakistan. The Pakistani students were particularly interested in learning of the discovery of the new elements einsteinium, fermium, and mendelevium whose synthesis had been announced during the summer of 1955. Indicative of the hope and pride of the Pakistani people in their new republic, the students suggested the name of pakistanium or pakistine, should one of their countrymen succeed in synthesizing a new element. From this discussion with Pakistani students the idea evolved of classifying the chemical elements according to the derivation of their names.

It is recognized that any attempt to add to the already large number of schemes for the classification of the elements must have merit if it is to receive serious consideration. The classification proposed herewith is in no way to be considered as a substitute or replacement for arrangements based on atomic numbers or electronic configurations but rather as an adjunct to these schemes. A thoughtful consideration of the classification based upon the derivation of names should fruitfully focus the attention of the student upon the many interrelationships between chemistry and astronomy, biography, geography, history, mythology, and foreign languages. From this viewpoint, a strong claim may be made for the study of general chemistry as a part of general education.

A CLASSIFICATION OF THE CHEMICAL ELEMENTS ACCORDING TO THE DERIVATION OF THEIR NAMES

I. Names of Celestial Bodies

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
Cerium	Ce	58	1803	Ceres, a planetoid discovered in 1801.
Helium	He	2	1878	Helios, Greek for sun. Discovered in solar spectrum.
Mercury	Hg	80	Ancient	Mercury, a planet. Symbol Hg. Latin, Greek, Hydrargyrum-water-silver.
Neptunium	Np	93	1940	Neptune, a planet discovered in 1846, next to Uranus.
Palladium	Pd	46	1803	Pallas, a planetoid discovered in 1802.
Plutonium	Pu	94	1940	Pluto, planet discovered in 1930; farther out than Neptune.
Selenium	Se	34	1817	Selene, Greek for the moon.

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
Silver	Ag	47	Ancient	Luna, Latin for the moon. Symbol, Ag for Latin argentum. (See also Miscellaneous.)
Tellurium	Te	52	1798	Tellus, Latin for the earth.
Uranium	U	92	1789	Uranus, major planet discovered in 1781.
II. Names of Continents				
Americium	Am	95	1944-45	America, discovered in America.
Europium	Eu	63	1901	Europe, discovered in Europe.
III. Names of Countries or States				
Californium	Cf	98	1950	California.
Copper	Cu	29	Ancient	Found on the island of Cyprus. Latin, cuprum.
Francium	Fr	87	1939	France.
Gallium	Ga	31	1875	Gallia, Latin for France and adjacent areas.
Germanium	Ge	32	1886	Germania, Latin for Germany.
Magnesium	Mg	12	1808	Magnesia, a district in Thessaly, Greece.
Manganese	Mn	25	1774i*	"Black magnesia" mistaken for magnesia. Also listed under VII.
Polonium	Po	84	1898	Poland.
Rhenium	Re	75	1925	Rhinus, Latin for Rhineland and Rhine River.
Ruthenium	Ru	44	1844	Ruthenia, old name for Russia.
Scandium	Sc	21	1879	Scandinavia involving Norway, Sweden, and Denmark.
Thulium	Tm	69	1879	Thule, old name for Scandinavia.
IV. Names of Cities or Towns				
Berkelium	Bk	97	1950	Berkeley, California.
Erbium	Er	68	1843	Ytterby, Sweden.
Hafnium	Hf	72	1923	Hafnia, old name for city of Copenhagen.
Holmium	Ho	67	1878	Holmia, Latin for Stockholm.
Lutetium	Lu	71	1907	Lutecia, old name for Paris.
Strontium	Sr	38	1808	Strontian, Scotland. In mineral, Strontianite.
Terbium	Tb	65	1843	Ytterby, Sweden.
Ytterbium	Yb	70	1878	Ytterby, Sweden.
Yttrium	Y	39	1843	Ytterby, Sweden.

i* *Date Isolated.*

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
V. Names of Noted Scientists				
Einsteinium	Es	99	1954	Albert Einstein, 1879-1955. Swiss-German-U.S. Scientist.
Curium	Cm	96	1944	Pierre Curie, 1859-1906. Marie Curie, 1867-1934.
Fermium	Fm	100	1954	Einrico Fermi, 1901-1954. Italian-U.S. Scientist.
Gadolinium	Gd	64	1886	Johan Gadolin, 1760-1852. Finnish. In mineral Gadolinite.
Mendelevium	Md	101	1955	Dmitri Mendeleev, 1834-1907. Russian Scientist.
Nobelium	No	102	1957	Alfred Nobel, 1833-1896. Swedish Scientist for whom the Nobel Institute for Physics was named. Element named for the Institute.
Samarium	Sm	62	1879	M. Samarski, Russian mining engineer. In mineral Samarskite.
VI. Names of Mythological Characters				
Cobalt	Co	27	1737	Kobolds, German goblins. Kobolos, Greek for demon.
Nickel	Ni	28	1751	Kopparnickel, Swedish for false copper. Also, Nikolos, a goblin.
Niobium	Nb	41	1801	Niobe, the daughter of Tantalus. First isolated in 1864.
Promethium	Pm	61	1945	Prometheus, the Greek Titan who brought fire to earth from heaven.
Tantalum	Ta	73	1802	Greek, Tantalos, son of Jupiter.
Thorium	Th	90	1829	Thor, Norse God of thunder.
Titanium	Ti	22	1791	Titans, fabled giants in Greek mythology.
Vanadium	V	23	1830	Vanadis, a Scandinavian Goddess.
VII. Names Derived from Physical Properties				
Barium	Ba	26	1808	Barys, Greek word for heavy.
Bismuth	Bi	83	1737	Origin uncertain, "weisse mass" shortened to "wismat." Latinized to bismat.
Bromine	Br	35	1826	Bromos, Greek meaning stench.
Cesium	Cs	55	1860	Caesius, Latin for sky blue.
Chlorine	Cl	17	1774	Chloros, Greek for green. Elementary character reported in 1810.

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
Fluorine	F	9	1771	Fluo, Latin meaning to flow. Not isolated until 1886.
Gold	Au	79	Ancient	Gold — an Anglo-Saxon word. Aurum, Latin, for yellow or "shining dawn."
Indium	In	49	1863	Indicum, Latin for indigo-blue. Name from blue line in its spectrum.
Iodine	I	53	1811	Iodes, Greek for violet.
Iridium	Ir	77	1804	Yields iridescent salts. Iris, Greek for rainbow.
Manganese	Mn	25	1770	Confused with magnetic iron. Magnes, Latin for magnet.
Osmium	Os	76	1804	Osme, Greek, meaning to smell.
Platinum	Pt	78	1748	Platina, Spanish for little silver. Discovered in South America. Silvery color.
Praseodymium	Pr	59	1885	Prasinos, Greek for leek green. Didymos, Greek for twin.
Rhodium	Rh	45	1803	Rhodon, Greek for rose-colored.
Rubidium	Rb	37	1861	Named for red line in its spectrum. Rubidus, Latin for red.
Thallium	Tl	81	1861	Named for green line in its spectrum. Thallos, Greek for green twig.

VIII. Names Derived from Chemical Properties

Actinium	Ac	89	1899	Aktis, Greek for ray. Emits rays.
Antimony	Sb	51	Ancient	Antimonus, Greek for opposed to solitude. Stibnite, mineral containing Sb.
Argon	Ar	18	1894	Argos, Greek for inactive.
Astatine	At	85	1940	Astator, Greek for unstable.
Chromium	Cr	24	1797	Compounds are highly colored. Chroma, Greek for colors.
Dysprosium	Dy	66	1886	Dysprositos, Greek for hard to get at.
Lanthanum	La	57	1839	Lanthano, Greek verb meaning to conceal.
Oxygen	O	8	1772	Oxys, Greek for bitter; genes, Greek for forming. (See Hydrogen.)
Phosphorous	P	15	1669	Phosphoros, Greek for light bearing.
Protactinium	Pa	91	1917	Protos, Greek for first.

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
Radium	Ra	88	1898	Aktis, Greek for ray. Radius, Latin for ray.
Radon	Rn	86	1900	Same as above with nonmetal ending "on."
IX. Names Derived from Minerals, Ores or Chemical Compounds				
Aluminum	Al	13	1825 1827i*	Alum. Alumen, Latin for astringent.
Arsenic	As	33	Ancient 1725i*	Arsenicon, Greek for name of a yellow mineral.
Beryllium	Be	4	1798 1828i*	Berl, a precious stone.
Boron	B	5	1808	Borak, Persian for white.
Cadmium	Cd	48	1817	Kadmia, Greek for cadmean earth.
Calcium	Ca	20	1808	Calx, Latin for lime.
Carbon	C	6	Ancient	Carbo, Latin for coal, charcoal.
Hydrogen	H	1	1700	Hydor, Greek for water; genes, Greek for "Gives birth to."
Molybdenum	Mo	42	1778 1781i*	Molybos, Greek for lead. Found in a lead ore.
Nitrogen	N	7	1772	A constituent of niter, KNO_3. Gives birth to niter.
Potassium	K	19	1807	English, potash. Latin, kalium.
Sodium	Na	11	1807	In soda, Latin natrium.
Sulfur	S	16	Ancient	Solvere, Sanskrit for sulfur.
Silicon	Si	14	1824	Silex, Latin for flint.
Tungsten	W	74	1783	Tungsten, Swedish for heavy stone. Symbol from occurrence in mineral Wolframite.
Zirconium	Zr	40	1789 1824i*	Zerk, Arabic for precious stone. Occurs in the jewel zircon.
X. Names Derived from Miscellaneous Sources				
Iron	Fe	26	Ancient	Iron, an Anglo-Saxon word. Symbol from Latin ferrum. Known as "the metal from heaven," in several early languages, because of its presence in meteorites.
Krypton	Kr	36	1898	Kryptos, Greek for hidden.
Lead	Pb	82	Ancient	Lead, an Anglo-Saxon word. Symbol from Latin plumbum.
Lithium	Li	3	1817	Lithos, Greek for stone.
Neodynium	Nd	60	1885	Neos, Greek for new. Didymos, Greek for twin.
Neon	Ne	10	1898	Neos, Greek for new.
Silver	Ag	47	Ancient	Anglo-Saxon word seolfor. Symbol from Latin, argentum for white.

Element	*Symbol*	*Atomic Number*	*Date of Discovery*	*Derivation of Name*
Technetium	Tc	43	1937	First man-made artificial element. Technetos, Greek for artificial.
Tin	Sn	50	Ancient	Tin, an Anglo-Saxon word. Symbol for Latin, stannum.
Xenon	Xe	54	1898	Xenos, Greek for stranger.
Zinc	Zn	30	1374	German, Zink.

DATE OF DISCOVERY

Some divergence is found with respect to the dates given for the discovery of certain elements by different chemical historians and by different textbooks. Indeed, not only the date but the individual or individuals who should be credited with the initial discovery of some elements are open to question and/or interpretation. The dates listed in the preceding table are, in most instances, those given in Week's *The Discovery of the Elements* (1). The date given may refer to the time when a publication announced the discovery, or it may designate the time when experimental evidence was obtained indicating the discovery of a new element. When an element was first isolated in reasonably pure form, it was sometimes many years after its discovery. More than a century separated the discovery of fluorine in 1771 and its isolation in 1886.

In 1846, Professor Walter R. Johnson assembled a *Table of Simple Substances* (2) in which he listed fifty-four then known elements including the "Date of Discovery and Discoverer." A number of his dates have been changed by later writers due to further search of the literature. For iron, lead, tin, copper, and mercury, the Johnson Table reported "Known from time immemorial" while no date or statement is made for carbon or sulfur.

SOME DEFUNCT TWENTIETH-CENTURY ELEMENTS

Elements 85 and 87, Alabamine and Virginium

The search for element 85, the unknown halogen, and for 87, the missing alkali, was intensively pursued for many years. In 1930, Allison and Murphy of Alabama Polytechnic Institute, announced the discovery of these elements using a magneto-optic method (3). The name "alabamine" reflected the state and school where the work was done, while "virginium" suggested the state where Allison was born. These names are found in lists of elements in American textbooks published for several years after 1930. However, as so often happened in the search for these elements, the work was not verified and, again, 85 and 87 were left blank in the periodic table.

Evidence for element 85 was found in 1940 by workers at the University of California (4). The new element was prepared by bombarding bismuth with alpha particles. It appears to be entirely a synthetic product with no known stable isotopes. The longest lived isotope, At^{210}, has a half-life of only 8.3 hours. The name "astatine" was chosen from the Greek word signifying unstable.

The final identification of element 87 was made in 1939 by Mlle. Margarite Perey (5) while working at the Curie Institute in Paris. She found actinium

atoms with a mass number of 227 exhibit a branched disintegration. In addition to the well-known beta decay, there is a simultaneous alpha particle emission with the formation of a nuclide having a mass number of 223 and the atomic number 87. At first the new element was designated as "actinium K," but soon this was altered by Mlle. Perey to "francium" in honor of her native land. Thus the unknown alkali was finally identified and found to be a naturally occurring element. However, isotopes other than Fr^{223} have been made which are the product of artificial disintegration series.

Element 61, Illinium, Florentium, Cyclonium

In 1926, Harris and Hopkins of the University of Illinois sent a communication to the American Chemical Society (6) reporting that they had obtained spectral lines identifying the element 61. This they named "illinium" in honor of the University where the work was done. For more than a decade after this announcement illinium was listed in many chemical textbooks. However, all efforts to reproduce the evidence upon which the existence of illinium and florentium were claimed proved unsuccessful.

At the Royal University of Florence in Italy, in 1924, Rolla and Fernandes (7) obtained evidence from a rare earth concentrate which they interpreted as indicating the presence of element 61. They proposed the name of "florentium" in honor of the City and University of Florence.

In 1941, a group of workers at Ohio State University (8) reported evidence for element 61 when bombarding samples of neodymium and samarium. It appeared to be radioactive. This claim was confirmed by Wu and Segrè (9), but the method was not powerful enough to give convincing evidence. The Ohio group had used the cyclotron in their work and, accordingly, suggested the name "cyclonium" for this element.

In 1947, the atomic pile gave the final confirmation for element 61 when a group of research workers (10) obtained it from uranium fission products using an ion-exchange resin method for the final separation. This element was also produced by neutron irradiation of neodymium. The name "promethium" was given to the element in memory of the Titan in Greek mythology who stole fire from heaven for use on the earth.

Element 43, Masurium

In June 1925, Noddack, Tacke, and Berg (11) announced the discovery of elements 43 and 75. Their claims for the discovery of these new elements were based upon certain lines in the X-ray spectrum of material which had been concentrated from certain ores and minerals. Compounds of element 75, rhenium, are now rather common, but the evidence upon which they claimed 43 was not substantiated by subsequent work. The name "masurium" was given to element 43 for Masurenland, East Prussia. This name and the symbol Ma are frequently found in chemistry textbooks published between 1926 and 1937.

While working in Rome, Italy, during the year 1928 to 1935, Emilio Segrè investigated possible sources of element 43. Following this Segrè and Perrier at the Royal University of Palermo worked with a sample of molybdenum which had been bombarded with deuterons (12). This and subsequent work in the United States led to the final identity of element 43. It is present in the fission products of uranium as well as being produced

when molybdenum is bombarded with deuterons. It has also been made by bombarding niobium with helium ions. Since it is entirely a synthetic element it was named "technetium" from the Greek word for artificial.

Element 72, Celtium

Working with rare-earth residues, in 1911, Urbain (13) obtained an arc spectrum which was interpreted as being indicative of element 72. It was named "celtium" in honor of the Celts, an ancient people living in central and northern Europe. The term was sometimes more specifically used to designate the Celtic-speaking people of France, Great Britain, and Ireland.

Subsequent considerations and investigations indicated that element 72 would not be found with the rare earths but should be sought as a member of the zirconium family. Thus it was in a zirconium ore that Coster and Hevesy, in 1923, discovered the long missing element 72. It proved to have the characteristics of a member of the zirconium family. It was named "hafnium" in honor of Copenhagen, the capital city of Denmark. The early name of this city was Havn which had been Latinized to Hafnia.

OBSOLETE AND POLEMIC NAMES

Element 4, Glucinum, Glucinium

For more than a century after its discovery in 1798, element 4 was frequently designated as "glucinum" or "glucinium," symbol Gl, coming from the Greek word "glykys" meaning sweet. The soluble salts of this element have a sweet taste. Vauquelin, who discovered the element, suggested a name connected with its source, from the mineral beryl, but his French compatriots pressed for the name suggesting the sweet taste. In French, the name glucinum continues to be the preferred term.

In 1828, Wohler, the noted German chemist, isolated element 4 and suggested the name beryllium by virtue of its presence in the mineral beryl. Thus despite the preference of certain French chemists, the name beryllium, which Vauquelin initially suggested, has become generally accepted.

Element 7, Azote

Element 7 was recognized as a distinct substance in 1772 by the Edinburgh botanist and physician, Rutherford. As it would not support life, he called it "mephetic air," i.e., poisonous air. The eminent French chemist, Lavoisier, established the fact that this gas is an element. He named it "azote" meaning without life. It was by this name and the symbol Az that this element was designated in scientific French until recent years.

The French physician-chemist, Chaptal, suggested the name nitrogen for element 7 in 1823. This was derived from the Greek words for saltpeter and to produce.

Element 41, Columbium

Charles Hatchett, an English chemist, announced the discovery of a new element in 1801. It was found in a mineral specimen which had been sent to him from Massachusetts or Connecticut. In honor of the United States the mineral was called "columbite" and the element "columbium" with the symbol Cb. This was the first element to be discovered in a mineral from North America. During the subsequent decades there developed some uncertainties with respect to the identity of columbium.

In 1844, the German chemist H. Rose, clearly distinguished between col-

umbium, found in the American columbite, and tantalum, an element with similar properties, found in Bavarian tantalite. Rose gave element 41 the name "niobium" notwithstanding the fact that it had already been designated as columbium. Until recently this element was called columbium in the United States and niobium in Europe. In 1949, the Commission on Inorganic Nomenclature of the International Union of Pure and Applied Chemistry (IUPAC) ruled that the official name is to be niobium.

Element 71, Cassiopeium

The French chemist Urbain announced the discovery of a rare earth element in 1907, the oxide of which he named "lutecia." Later the spelling was changed to "lutetia," and the name of the element became "lutetium." International rivalry is evident in the fact that Auer von Welsbach, an Austrian chemist, discovered this same element at about the same time as Urbain. He named it "cassiopeium," symbol Cp, for the stars in the constellation of cassiopei. Although the name lutetium has been generally accepted, German periodicals prefer the name cassiopeium.

Element 74, Wolfram

This element was discovered by Scheele in 1781 in a mineral called tungsten. It was also found to be present in the mineral known as wolfram or wolframite. In Germany, the name wolfram and symbol W have long been accepted. In other countries, it has frequently been called tungsten, but the symbol W has been used. In 1949, the Commission on Inorganic Chemical Nomenclature of the International Union of Pure and Applied Chemistry ruled that the official name was to be "wolfram." However, due to pressure from British and American chemists, in 1951 the IUPAC rescinded its approval of the name wolfram.

Element 86, Radium Emanation, Niton

Upon its discovery in 1900 by Dorn this element was called "radium emanation" as it emanates from radium. After its isolation in 1908 it was called "niton," symbol Nt from the Latin word "nitens" for shining. In 1923 the name was changed to "radon" indicating its origin from radium. Sometimes the term niton was used to designate the isotopes radon, actinon, and thoron, each of which has the same atomic number but are the decomposition products of radium, actinium, and thorium respectively.

CHANGED SYMBOLS

Recently the symbol for argon has been changed from A to Ar; that for einsteinium from E to Es, and, because some languages do not have the letter "v," the symbol for mendelevium has been changed from Mv to Md.

SUMMARY

In summary it may be said that the classification of the chemical elements as proposed in this paper, with the accompanying interpretation of the source and meaning of each name, offers a unique opportunity to emphasize the interrelationships of chemistry with other areas of academic study. In addition, it is evident that an effort to interpret the source and/or meaning of certain terms may add significantly to the students' understanding and resourcefulness.

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The years ahead will be no time for the timid but for the man who is not afraid; who has faith in himself; has a proper scientific background, and is willing to work.

Wilbur J. Teeters, Am. J. Pharm. Ed., 7, 105 (1943)

PROFESSIONAL ATTITUDE AND EDUCATION*

R. E. KREMERS

To honor Edward Kremers' memory I have chosen the subject of Professional Attitude and Education because it was his lifelong purpose to advance the professional standing of pharmacy. The esteem with which our profession is held in any community is the net result of the impressions created by the men and women who practice pharmacy in that community. Accordingly Edward Kremers sought to further professional status by influencing the attitudes of individual pharmacists. He did this through his career as a teacher, through his participation in the work of pharmaceutical associations, through his contacts with the State Board of Pharmacy, and through his writings. Of these various channels, we shall be concerned with his career as a teacher.

In this capacity Edward Kremers carried on three lines of endeavor. He was concerned first of all with instruction of students, both undergraduate and graduate. He vitalized his teaching and promoted graduate study through his researches on volatile oils or other constituents of medicinal plants. He sought to keep a proper perspective and to develop a wider sense of the dignity of the profession through his study of the history of pharmacy. These endeavors not only influenced his students and others interested in pharmacy, but also provided the experiences from which he evolved his own professional concepts and goals for the profession.

Our topic, therefore, seems appropriate for the occasion. I judge that it is a timely subject too, because it is widely discussed. During the past several years *Chemical and Engineering News* has printed numerous items from the debate over the unionizing of chemists and engineers. The status of the medical profession has become a political issue. And the press is filled with arguments over the merits of liberal arts colleges as opposed to technical schools. Obviously there is much confusion about what gives a person professional status.

In the discussion that follows I shall first present a definition of professional attitude, then point to some of the educational implications of this definition, and, lastly, consider whether so much emphasis on the development of professional attitude is justified.

PROFESSIONAL ATTITUDE

We noted above, at least by implication, that a professional person is recognized by his attitude toward his work and toward the people with whom he deals. Since some of the professions have had a long history, we might expect that the definition of what constitutes professional attitude has been well established. But as soon as we start reading the literature it seems that there are almost as many definitions as there have been writers. Certainly there is no absolute or categorical answer. But as we probe further, it is apparent that not all is confusion, that actually there is a good deal of agreement on some parts of the problem. It helps our

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thinking to classify the various definitions that have been advanced in the past. For example, a recent writer used three headings: historical, operational, and persuasive (1). My own preference would be for: historical, legalistic, and philosophical.

Under the heading of historical definitions, we can cite the Oath of Hippocrates, not only because of its origin in antiquity, but also because of the tremendous influence which it has had through the centuries. An historical definition with a very different connotation was that a professional person must have a fluent command of Latin and Greek. But the era when the classics were the hallmark of the professional person has passed. Another use of the word "professional," which has historical sanction, but an entirely different context, is in the field of sports where it is the opposite of amateur. Current literature shows a tendency by some writers to use the word professional as the equivalent of artisan. With such a wide range of connotations, the term learned professions has long been used to minimize confusion. But no matter how valuable they may be, historical definitions by themselves are not adequate for our needs.

So we come to a second group, the operational or legalistic definitions, notably the *Code of Ethics* of the established professions. Such codes are designed both to define the profession and to govern its members. It is interesting to observe that these codes tend to be somewhat negative. That is, they prohibit specific actions, whereas the statement of broad principles is often left to inference. For example, a lawyer should represent only one party to a suit; a chemical engineer should not conceal his own interest in a patent if his client has similar patents; a doctor should not split fees. In short, in order to be used as instruments of self government, these codes seem to have been reduced to the least common denominators of many individuals.

The third category of definitions includes those that are philosophic in content, or, as one writer expressed it, those which seek to persuade the membership to accept the higher standards implied by the codes. The philosophical definitions set the goals. They provide us with the concepts and ideas which we should strive to attain as individuals and as professional groups. Again there is no rigid distinction between a philosophical goal and a legalistic statement. For example, as long as we were undergraduates, the B.S. degree was a goal to be attained. After graduation it became a standard by which to judge others. You should note, too, that as we attain one goal, other goals arise. Accordingly, the philosophical definitions of our profession should provide for this sort of evolution.

With this background I submit for your critical consideration a philosophical definition which I developed from reading the codes of various professional societies. May I say that I believe it is entirely consistent with the Code of Ethics of our own American Pharmaceutical Association. My definition is:

> **A person has attained professional attitude when his daily conduct is characterized by (1) integrity, (2) acceptance of his employer's (clients, public's) welfare as his own, (3) competence, and (4) humaneness in dealing with others.**

The keys to this definition reside in the meanings which we attach to "integrity," "competence," etc.

1. Integrity denotes more than just honesty; it implies a capacity for the honorable discharge of a trust. Accordingly, there is a moral element in the concept of integrity which, perhaps, can be expressed a little more explicitly by saying that a person has integrity when he has achieved a consistent unity of thought, purpose, and action which enables him to discharge a trust honorably.

2. The requirement that a professional person accept his employer's or his client's welfare as his own is often phrased in the words that he places public service above material gain. In a sense, it means that his motives are largely altruistic. In passing, it may be said that one problem of our day is to translate this requirement into terms which are pertinent to and understood by the professional men and women who are employed in activities, such as industrial research, factory work, hospital work, or work in clinics.

3. Competence, as related to the older professions of theology and law, was concerned primarily with intellectual endeavor, but in pharmacy and the other professions based on modern science, it must be enlarged to include craftsmanship and manual skill. Particularly in this day and age, competence also means that one must keep abreast of the progress in his field. This necessitates a continuing growth through education and experience, whether formal or on the job.

4. Humaneness in dealing with others denotes kindness and tact, but even more, a genuine understanding of the way other persons feel and react. Here again we are faced with translating the ideas of a previous generation into terms that are relevant today. This requirement is no longer a one-way street. Beginning with the relations of a professional person to his client, it has now become essential to include the relations of the client (employer) to the professional, of one professional to another, and of a professional person to his employees or junior staff.

IMPLICATIONS FOR EDUCATION

If you will grant the general validity of my definition of professional attitude, we can examine it for implications that bear on education. The statement that professional attitude finds expression in our daily conduct immediately makes it clear that professional attitude is not something which is conferred upon us by an academic degree or a certificate from a state board of examiners. Conduct is something which we develop out of the give-and-take of our lives. It is the net result of our education, taken in the broadest sense of the term. For specific guidance let us turn again to the key words.

INTEGRITY

I do not know whether integrity is something which can be taught in the classroom like the multiplication table or whether, at the opposite extreme, it is something which is inherent in our genetic makeup. I suspect, however, that it is something which can be influenced, particularly by the force of example. I doubt very much that Edward Kremers ever lectured to any extent, even in private, on the subject of integrity. But I am sure

that few will question the belief that the example which he set as teacher and as scientist had a profound influence upon the integrity of his students and associates. I do not mean to imply that he was unique in this respect. All of us, I am sure, have had teachers of whom the same could be said. In fact I would assert that one of the great benefits of education in modern science and technology is its emphasis on the integrity of the individual as the essential requirement to all progress. So whatever changes we make in our educational program to adjust it to changing times, let us be sure that we do not weaken its influence on the development of integrity.

SERVICE

Obviously the desire to render service has much in common with the ideal of integrity. But I have a notion that educationally it is much more tangible. Most of us are genuinely thrilled when we make a discovery, even a trifling one, and there is no end to the classroom illustrations which we can draw upon to document the benefits to mankind that have followed discoveries. Another concrete influence is the increasing population pressure on our natural resources. This is forcing us to develop effective conservation practices based on the concept that sustained use is preferable to acquisitive exploitation. And through the derived technologies, science itself has induced such huge capital investments in plants, franchises and "know-how" that short-term profits under competitive conditions can seldom repay the investor. Consequently, management and owner philosophy is more and more taking on the character of a custodianship which emphasizes service to customers as the basis for continuity of business. With all these influences at work within and without the classroom it should not be too difficult to orient our students favorably toward the requirement that the professional person places public service above private gain.

COMPETENCE

Historically, professional competence has been taken to mean intellectual achievement. But to this group it is scarcely necessary to mention that competence has its operational requirements. No matter which way you turn, you see on all sides the refined, powerful, modern tools of scientific and technological operations. Merely to learn the mechanical manipulations of these instruments is no small task, and no school of pharmacy can consider itself up-to-date which does not provide ample opportunity and ample equipment for each student to acquire this experience. Perhaps it is worthwhile pointing out, however, that the mere routines of manipulation do not of themselves guarantee the proper use of an instrument. To be really well qualified we must know the principles which underly the operations, and above all the relations of these principles to the materials that are being measured or manipulated. One often hears that our schools must teach the theory as well as the practice of each science and technology. It is at this point that some of the sharpest and most valid criticism of our educational programs in pharmacy and other sciences has been leveled. It is claimed that we have trained technicians, but not competent technologists who comprehend what they are doing and what the social consequences of their acts will be. I will return to the point later. But I wish to emphasize that today, professional competence includes the mastery of techniques as well as the capacity for advanced intellectual endeavor.

Full competence can be developed only over a period of years and does not end with the granting of even the most advanced degree. Academically, then, we must recognize that the educational process here at the University is only the laying of a foundation. But by the same token the foundations must be as good as possible. This, let me emphasize, is a highly individual matter. We must be more and more explicit in our recognition of this fact as the numbers of students in our schools increase.

HUMANENESS

The requirement of humaneness in dealing with others brings us directly into the question of education in human relationships. In this connection there is much discussion about introducing courses on economics and communication into our pharmaceutical curricula. Such studies are important, but the question goes deeper than a selection of courses from the humanities and the social sciences. The roots of our problem lie in the fact that we live in an era of rapid technological change caused by the tremendous outburst of scientific inquiry. Our need is to develop a proper perspective in this new environment. More explicitly it is to "see our own activities in their social and human contexts, to understand our own objectives, methods and problems in relation to the objectives, methods and problems of men engaged in other activities." (2) In short, our educational program must give the student a foundation on which to build a sound philosophy of life.

So far I have discussed the implications of our definition of professional attitude with respect to the education of an individual. I would now like to bring it to bear on some questions of policy. I mentioned earlier that our scientific and technical curricula are often criticized because they do not develop the student into a well-balanced human being. But it does not follow from the juxtaposition of words that the remedy for the faults of our scientific education is to place primary emphasis on the humanities, especially when the humanities are taken to be synonymous with the system of education that was founded on the classics. We must not forget that history does not run backwards. To quote Whitehead: "All this is gone, and gone forever, Humpty Dumpty was a good egg so long as he was on top of the wall, but you can never set him up again." (3)

Obviously many elements must enter into the creation of the philosophy, or perspective, by which an individual relates himself to his environment. Since each person must evolve his own philosophy, it is easy to say that it is his own responsibility, that the problem is extracurricular. That was a prime assumption underlying the policy allowing students much freedom in choosing electives, and we know that the results were not satisfactory. Another facile answer is to say that science students need to take more liberal arts courses, thereby adding a year or two to their college careers. But I venture to assert that experience has already shown that this course of action, too, won't work. The cost of the specialized curricula, i.e., those which lead most directly to a self-supporting status, are already prohibitive for many students, and "education beyond the high school" is being subsidized as never before.

It is clear that the way out of this dilemma lies in the paradox that to broaden scientific-technical education we must intensify it. If we are

to have time for a wider range of subject matter, we must make it available by compressing all of the essentials of our present programs into a briefer span. We cannot continue to add a new chapter or a new course for each advance in knowledge; we must rethink and reorganize our science teaching. It is a prodigious task, but it must be done. And when we have started to put our own house in order we can more reasonably insist that instruction in the other fields of learning be similarly intensified.

Paralleling the controversy over the relative merits of the humanities and the sciences there is an argument going on within our own ranks over the importance of pure vs. applied science. We read about the importance of basic research to our national security, about the depletion of our store of theoretical knowledge, as though the operation of a law of nature exhausted itself and ceased to function. We are urged to embark on long-range researches, as though the length of the research were a justification in itself. I can see the merit of having the wisdom to anticipate the problems which must be solved, but surely the longer and the greater the effort to reach a solution, the greater the economic cost that must be paid off in the end. I often suspect that some of the academic arguments in favor of long-range research reflect a subconscious desire to escape from the realities of today. But that is beside the point. Edward Kremers was much too good an historian ever to subscribe to any notion that theory and application are separate and distinct entities. At best the distinction only reflects the attitudes of the worker. It is perfectly proper for an individual to decide that he himself is more adept in pure theory than in application, and vice versa. But there are many, perhaps the majority, of us who function better when we combine the two interests. "This intimate union of practice and theory aids both. The intellect does not work best in a vacuum." (4)

Edward Kremers maintained that the real problem lay not in the subject, but in the way it is taught; that any course could be presented in a narrowly pedantic fashion or it could, by hard work and inspiration, be both significant to science and relevant to human affairs. Much the same concept was expressed recently by a British writer: "To the injunction 'Teach your pupil to think' I should like to add the further injunction, 'Teach your pupil to see and feel.'" Then he added this comment: "*I have spoken as if* art, music, and poetry were the best media for our purpose. But, of course, it can be achieved through *any subject* . . . ." (5) (italicized by R. E. K.).

But the key words in our definition do more than set the goals, they provide the operational criteria by which we must analyze and improve our curricula. The basic question to which each course of study must be accountable is: what does it contribute to the student's knowledge, to his skills, to the development of his character (integrity), and to his philosophy of life? When we have the answers we will see more clearly just what it is that each of the sciences, the arts, and the humanities contributes to the development of a person. We will adjust the content of courses and programs much more effectively to the purposes of both general and specialized education. We will be able to give specific advice to the student. We will not just say to him, elect twenty credit hours in the humanities to offset your concentration on science. Instead, we will prescribe certain courses in art or poetry to stimulate his imagination, or certain other courses in mathematics and composition to discipline his imagination.

JUSTIFICATION

Let us turn now to consider the question of whether the continued existence of the professions in our social structure is justified. Let us remember that these professions as social institutions are but the formal expression of the attitudes of the individual and that it takes much time and effort to develop these attitudes. Do the results warrant this expenditure; in the slang of our day, what is the payoff?

Most of us are in the position that we must work to earn our living. Our professional competence is without question directly related to this necessity. Moreover, our concept of professional attitude requires us to continue to learn as we progress, learn not what merely is in the books, but to develop our skills through experience and practice. In this era of rapid technological and social change, our economic security in later life often depends very directly on our ability to continue to develop.

In a previous generation our professional requirements for integrity and service were often regarded as unrealistic because they were at variance with certain heritages of our frontier days. There the raw necessities of life fostered an attitude of skimming the cream off our natural resources, of making the most profit in a hurry and moving on. But our geographic frontiers and their lavish natural resources are gone. In the broader perspective and economic setting of today we realize that integrity and service lead not to economic loss, but in the end to greater opportunity and greater profits.

All these benefits are payoffs in the economic sense. But over and above our basic economic needs are the intangible benefits. As the years go by, if we are fortunate, we develop a sense of mastery over our work through the continued assimilation of the knowledge and the experiences we have gained along the way. Perhaps we become egotistic enough to feel that we have matured a bit of wisdom and a satisfying philosophy. But best of all is the reservoir of good will among our fellowmen. As my own experiences have taught me, it can be a priceless asset.

And now, in closing, I ask again that you think critically of the definition of professional attitude which I posed earlier. Analyze the meanings and implications of its key words. Modify or restate it as you see fit, provided only that you are intellectually honest with yourselves. Then give it reality through the medium of your lives, your daily decisions and actions. This will not be easy because we live in a time of uncertainty, of many complex problems. But the measure of our achievements will be set by the magnitude of the problems that we solve. Edward Kremers may never have put his thoughts into these words, but I am sure that they express his attitude as he dedicated himself to building this school of pharmacy.

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PHARMACISTS AND RESEARCH OPPORTUNITIES*

GEORGE SQUIBB

It is of course a great privilege and pleasure for me to have been given the opportunity to deliver the Crawford W. Long Memorial Lecture here in commemoration of the 116th anniversary of the first use of sulfuric ether in surgical anesthesia. As I have learned of the traditions established by this occasion over the years I have felt a deep realization of the feeling which Georgians have for Dr. Long, and their admiration for his genuinely significant contribution to the continuing struggle to push back the limits of our knowledge of medicine and the agents that are so useful in its practice.

It is naturally particularly gratifying to me to be able to participate in this Memorial to Dr. Long because my family has been so closely concerned for over 100 years in the development, production, and continual improvement of anesthetic ether. As you may know, Dr. Edward R. Squibb, my great-grandfather, in 1853 perfected the first practical method known of producing an anesthetic grade ether in the quantities that would be required to meet its expanding use as the word of Dr. Long's work and that of subsequent researchers was spread throughout the land. This discovery of an efficient procedure for manufacturing high-quality ether was actually made while he was in the Navy and five years before he founded the pharmaceutical house which now bears his name and introduced the product into regular professional use by physicians in private practice. Today ether is still the most widely used anesthetic and continues to play the vital role in medicine that Dr. Long foresaw for it in 1842. The longevity of useful life for ether as an anesthetic is even more remarkable when it is remembered that almost every other major drug in common use today is a recent discovery. It is in fact the only pharmaceutical product in our catalog today that has been there every year since 1858. In the fast-moving fields of medicine today when often a new drug becomes obsolescent within a few years of its first appearance, this fact makes ether a true "miracle drug." This incidentally is a term never used in 1842 nor 1858 when ether must have seemed just as miraculous as the antibiotics did to us fifteen years ago when they first appeared. It might seem that our ancestors lacked something of our feeling for the easy description and the catch phrase that has come to be a symptom of our times.

In any case not only are the careers of Dr. Long and Dr. Squibb curiously interwoven by their common interest in ether, one from the standpoint of its use, and the other from the standpoint of its production, but also by a remarkable parallel in their actual personal histories, achievements and characteristics. Both men were born in small towns—Squibb in Dover, Delaware, and Long in Danielsville, Georgia—and actually it is interesting to note that James Long, Crawford Long's father, came to Georgia from the very part of Pennsylvania where the Squibbs had their first roots. Both

*Crawford W. Long Memorial Lecture, 1958. Sponsored by Rho Chi Fraternity, University of Georgia.

Squibb and Long were trained as pharmacists and physicians, a duality of profession more common 100 years ago than it is today, but even then indicative of usual devotion to their chosen fields. As a matter of fact both men were graduates of the same Philadelphia medical school—Dr. Squibb only four years after Dr. Long.

These two men each in their separate ways were researchers in medical science. The fact that their first successful applications of their personal research efforts involved ether is perhaps not too remarkable a coincidence when their own background and the times themselves are considered. Certainly Dr. Long in his thoughts about painless surgery was reflecting a very common and serious problem in mid-nineteenth-century medicine. It was as natural for a man with his training to think in this direction as for a physician of our day to think of the problems of heart disease. Dr. Squibb in his research on production and purification of ether was also following the same logical course that a modern scientist does as he works out fermentation techniques for a new antibiotic. Both these men had original ideas—a remarkable thing in itself when we think of the old saying "there is nothing new under the sun"—and both men blazed the trail for thousands of men to follow after them—Dr. Long in the field of painless surgery and Dr. Squibb in the field of quality production. Both men had as their goal the safety and well being of the patient, and this through the years has been the great universal hallmark of medicinal research.

We have paid brief tribute to the careers of two men of pharmacy and medicine who by their restless and inquisitive minds and their perseverance and professional abilities contributed greatly to the progress of public health in the nineteenth century. In the light of their achievements both of these men today would be honored as researchers—seekers after the truth who successfully opened up new ground for those who followed.

In the last few years research has become very much a subject for top public attention throughout the world. Research, as I use the term, can be defined as a "critical or scientific course of inquiry." It includes the study of everything from salt to satellites, from mice to men, from sea to sky, from books to bombs, and from birth to death. Research in the last decade has opened new horizons of such startling scope that we haven't yet been able to grasp fully the potentialities that face us in the next few years as these subjects are pursued with steadily increasing fervor. Consider for a moment—and never has so much been encompassed in so few words—nuclear energy, radar, space travel, antibiotics, television, virus vaccines, heart surgery; all these and many, many more are achievements of our lifetime. Never in recorded history does any age even vaguely approach our own for the fruits of its research. Naturally I've got to limit my observations here today to one sort of research (or as I am going to try to point out to you) to research done by one type of trained men—those in the profession of pharmacy.

I am going to try to establish in your minds the idea that our need today is not only for so-called scientific research by men in our field, but also economic research, social research, distribution research, and several other interesting types in which our progress is decidedly more sluggish than in the scientific field. I am going to try to convince you that all of us as professional men (or men with a profession—there is a difference in those

phrases I believe) have as much of a call for study or a "course of inquiry," if you will, into many phases of our chosen field as those who concerned themselves with medicine, the human body, or life itself. I want to do this without minimizing the importance of medical research and the urgent need for practitioners in this field. I'm sure you realize that medical research is not by any means limited to performance by medical men or men trained in the medical sciences. Chemists, bacteriologists, biologists, biochemists, engineers, pharmacists, and often men with no formal classification, work productively today in medical research.

Most, if not all, of us here are concerned with pharmacy in some of its many facets, and one of our vital interests naturally is the application of the newly developed research techniques to our chosen profession. Many of you students are thinking no doubt of careers in pharmaceutical research in hospitals, government, or industry. Many of you are planning to answer the call that is heard throughout the country for more and better trained scientific men to ensure maintenance of American technological leadership. Certainly no one can, or should, attempt to do anything but encourage such plans. The shortage of top-flight young men coming up from our professional schools to devote themselves to laboratory work in medical fields is apparent to all of us. Much is being said and written on all sides of the causes and the effects of this shortage. Critical comparisons are made of our school system with those of European countries. A national magazine only last week devoted a major part of its space to an analysis of the American and Russian high school programs with the apparent purpose of making a direct contrast in their scientific training content. Sunday supplements and legislative reports are devoted to the caliber of education in these United States with the premise that we are not producing enough nor properly training research workers, engineers, and technicians of one sort or another. They point to statistics which show without doubt that more of all of these categories of career scientists are being produced in Russia, and even in Germany and France, and in short that we should do something about it and *now*.

I'm sure all of us agree with this argument, both in principle and in practice, but let's not let it carry us away to another extreme which can be much more disastrous to our welfare than the difficulties in which we now conceive ourselves to be. It is often our custom in these days in this great country of ours to burn down the barn to get the rats out. When properly aroused we can solve any problem, including our current crisis in education, but also in our enthusiasm and drive to get this job done we tend to create even worse problems from which we then have to extricate ourselves. My point here today is that those of us trained and skilled in pharmacy and medicine and their allied professions are in a position to take the lead, and should take the lead in producing scientifically trained men for all sorts of research and not for just that technology that is so prominently featured in today's publicity.

Let me explain myself further. Research is defined as a critical or scientific course of inquiry. There is nothing here in this definition that limits research to a technical field. Nothing that requires it to be made in one of the sciences. Nothing that says that the only gain for the world from research can come from laboratories devoted to the investigation of

some form of matter or some physical procedures. There are countless other types of problems awaiting research, the successful solutions of which are just as important to our future as any problem in the physical sciences. And professional men such as yourselves are best qualified to work in these areas. Before we get into a discussion of these other research possibilities, let us consider briefly the status of medical research as of today.

Far from trailing the rest of the world, American medical research has without question been the most productive and the most progressive. This is particularly true insofar as new drugs and new uses for old drugs are concerned. American label pharmaceuticals and medicinals have taken over the leadership in world markets held twenty years ago by the Germans. There are no finer drugs, no better medical techniques than those developed by medical research in this country in the last twenty-five years. We do not have to in any way reproach ourselves for shortcomings in this area. Surely there are many things left to be done, and a lack of money and personnel to do them, but this will always be true because every discovery made opens up ten more opportunities for further study. But there is no doubt that American medical research is in good shape, and that the men who work in these fields are superbly qualified. Prospects are good for more progress in the next ten years than in the last fifty, and in truth we appear to be living in an Age of Medicine.

Let's consider now, though, some other research opportunities that exist today. Perhaps these are not receiving the attention they must have, and, therefore, present a real challenge to professional men. All of these things are problems that urgently need solution, not only for the public welfare in general, but, more specifically, so we can fully benefit from the tremendous advances in medical science twentieth-century research has produced.

Let's start with the problem of the distribution of pharmaceuticals and medicinals. How can the American people, and indeed the people of the world, be best served, best protected, and most benefited by the products of modern medical science? This is a question that goes right to the heart of our lives and careers in pharmacy. Finding the answer to it is probably the biggest challenge before any one of us today.

Pharmacy and medicine have undergone tremendous changes since Dr. Long operated his drugstore a few miles from here in 1842, and yet the forces that are affecting pharmacy right now in 1958 portend even more revolutionary developments in the next five or ten years. Taking the retail pharmacy of today as our starting point, just let your mind go over some of the questions which must be answered before we reach the optimum level of service which is expected of us. What should be the place of pharmacy today in the community? What is the proper relationship of physician and pharmacist? How can a pharmacist best serve the health needs of his customers? How can the pharmacist work with the dispensing physician? How about the wholesaler and the pharmaceutical manufacturer —what part should they play in relation to the support of the pharmacist as a professional man and as a business man?

There are major new developments in pharmaceutical distribution today that need the most careful study and research if the correct path is to be followed into the future. You ladies and gentlemen here this morning will

have to find your way over a confused road, and we are very much in need of a critical course of inquiry into these matters *now*. For example, all of you are familiar with the emergence in recent years of mail-order houses, and door-to-door peddlers as important factors in the distribution of many items formerly sold exclusively in the retail drugstore. Is this a good thing? Is the public health benefited by these services? If not what should be done to counter this trend? How can we do it? What limits should be set? These are not easy questions. Among ourselves we may think we know the answers, but when we study further we become unsure that there isn't more to our distribution problems than can be solved by marking off arbitrary market allocations or passing restrictive legislation. A study of the underlying causes of the current shifts in public viewpoints on our operations may show that a fundamental revision in our basic thinking is called for.

The same thing can be said for the modern development of the medical clinic which more and more often is beginning to have its own pharmacy, and thus causing major readjustments in existing drug outlets. I'm not too familiar with this situation in Georgia, but I was in a town in the middle west a few days ago which is undergoing a radical change in its drugstores' services. It seems that the ten leading physicians there have formed a clinic and opened a pharmacy in the new building. This store is opened from nine to five every week day and in that time gets virtually all the prescriptions and much of the professionally created business in nondrug fields. The four established pharmacists in town are suffering very heavily. Two of them feel they may have to close. The others in order to survive may have to cut down their services, shorten their working hours, and cut costs wherever possible and possibly concentrate on nondrug product lines. Is this a good situation for that community? We could debate that question for hours, and still not be certain of the answer. But an answer must be found, and soon, or there will be unnecessary hardships for all concerned —all to the detriment of the public.

The hope for satisfactory resolution of this sort of problem is found best in people such as you men and women trained in pharmacy, thoroughly familiar with its history, its traditions, its products and its people. Here is a major area for research to guide us into the future with the goal of better health and well being.

In recent years the hospital has taken a new and vastly more important place in our communities—not because more people are ill but because we can keep more people well with modern medical techniques and drugs, and can cure more of those who do need attention. There are more babies, more old people, and a fuller realization of the best ways to guarantee their continuing good health. Group insurance plans are universal, with hospitalization a chief feature, and people are taking advantage of institutional services as never before. The hospital has become a social force that must be understood, and properly evaluated in relation to the physician and the pharmacist so that gains already made can be maintained and progress continued in the future to the benefit of all.

The hospital pharmacist is taking on a much more significant role as the position of the hospital itself develops and expands. Now he often has the difficult assignment of conducting himself both as a business man and

a professional man as he takes over part of the responsibility of keeping hospital costs under control. Again here is a shifting relationship within established pharmaceutical operations. The manufacturer, the retailer, the educator, all have to adjust themselves to the new place that hospitals, public and private, are taking for themselves. The proper adjustment is a fit subject for intense research if serious dislocations in existing procedures are not to occur—again resulting in detriment to the public.

And then the age of medicine itself with its miraculous new drugs and techniques is bringing enormous changes to the world of pharmacy, changes which must be understood, and met with full awareness of their inevitable results, if we are to derive from them the maximum benefits which they can bring. New drugs today are expensive and potent. They have strong economic effects as well as therapeutic. These range from difficulties in prescription pricing and the public acceptance of higher charges to the problems caused by shifts in facilities needed to care for the ill. For example the decline in beds for tubercular patients, and the increase, but change in nature, of requirements for the care of the mentally ill, the antibiotics, the ataractics, the corticosteroids, the new virus vaccines, all have had and are having a tremendous effect on the economics as well as the practice of pharmacy and medicine today. It will require the most thoughtful study by all of those working in these fields to utilize these new weapons to full advantage.

There are at least two other areas in which research is urgently needed on a continuing basis year in and year out. All I've said up to now makes this so very obvious. We need our best thinking in pharmacy education, and in pharmacy legislation. Big changes are under way already in both these fields, but who can say we've found the ultimate answers? Obviously we have not and we will not unless our best trained and most intelligent people devote themselves to these matters.

Pharmacy education is perhaps receiving more attention now from the point of view of curricula, range of subject matter, facilities and personnel than ever before in its history. The more such attention it receives the more it will appeal to young people in its productiveness and in its influence on our forward progress. How to train pharmacists for the new demands of public health, for the ever-changing patterns of medical and pharmaceutical trends, is a matter of major concern today, and you are the best qualified people to be thinking about it and finding the answers.

Pharmacy legislation directly or indirectly affecting our professional and economic interest is more important today than ever before. In order to know what we should be striving for in this area we must better understand the place that the pharmacist has as a trained professional in our communities, the place that pharmacy itself has in our national economy, the significance of the potent drugs now on the market and how they should be controlled, the facts of economic life and the profit motive. All of these things and many more are now subject for legislation—federal, state and local. The best answers must come from those trained in pharmacy—those who have given careful and critical inquiry to these problems—to decide what is needed or is advisable in legislation. Unfortunately pharmacy has not always made its voice heard in this area. Its wisest and best informed

men have all too often not been heard in legislative chambers with the result that ill-considered and unsound laws have come into being. Better organized research and study by all of us associated with pharmacy is an essential in this vital area. None of us can be exempt from the duty of careful thought and attention to the development of legislation affecting our chosen profession.

In the last ten or fifteen minutes I've raised a lot of questions, and supplied no answers. I've tried to show an urgent need for intelligent research and study by trained men and women in many parts of pharmacy other than the medicinal fields. I've tried to establish in your minds the absolute necessity for attention to these matters—a necessity just as great as that felt by those striving to discover some new therapeutic agent.

By no means are all of our ills today medical ones. Perhaps our economic, legislative, and professional problems can make more trouble for us than our physical difficulties. Certainly they offer today the chief and most serious obstacles to our continued advancement towards a better world through complete utilization of our scientific achievements. Mankind has not kept step on its economic and social development with its scientific progress.

Over the years pharmacy and medicine have produced many men who, like Dr. Crawford Long, have met a challenge of their times. Challenges—there are plenty today. We must meet them all.

Pharmacy carries within itself perhaps more than any other calling the seeds of its own success or failure. We cannot blame others for their indifference to our problems or their lack of understanding of our goals if we ourselves do not properly represent them. This can only come through the realization by trained men and women, such as yourselves, that yours is a profession that has evolved from the research and study of countless pharmacists who have gone before you. It is up to you to determine your own future and by so doing to determine the future of many of the finest traditions of our great country.

There is a definite relationship between education and leisure that is difficult to define. To accomplish most there must be some leisure in educational processes. The process of education knows what to do with leisure because it has been brought up with it.

Rudolph A. Kuever, Am. J. Pharm. Ed., 7, 75 (1943)

VALUES*

HENRY S. McNEIL

We live in an age of inconsistencies. This is an age in which day laborers often are paid higher salaries than school teachers; an age in which a late model automoble is accepted as a barometer of social position—even with the finance company holding the title. An age in which people spend almost as much each year to be buried as they spend on medicines to keep them alive. It is, at the same time, an age when an hysterical United States public frantically tries to obtain Asian flu vaccine for that relatively mild disease, yet calmly accepts the fact that 810,000 will die this year from atherosclerosis. An age when Mabel would rather buy a polio policy than have the vaccine.

This is, in short, an age of confused values, and I know of no field of human endeavor in which public evaluation is more confused than in the broad profession of pharmacy.

It isn't hard to cite a current example. Just a few weeks ago, while my wife and I were visiting friends, the conversation turned to a recent pharmaceutical discovery which had been reported in considerable detail in a popular magazine. My friend's wife was particularly enthusiastic about this new development, because she felt her mother could probably be benefited, and she was eager to learn all she could about it. We must have talked on that one subject for half an hour, and the lady more than once expressed awe and admiration of the things that are being accomplished in modern pharmacy.

Now, just the day before yesterday I heard from that woman again. She telephoned me at the office, advising me that now her daughter was in bed with a kidney infection, and that the family doctor had prescribed an antibiotic. Then came the classic question: "Can you get it for me wholesale?" (This, in spite of the fact that when it comes to money, men get their faces on it—but the women get their hands on it!)

To return, this was not an isolated incident, as I'm sure you are aware. People today are inconsistent in their sense of values. This woman, who had so lavishly praised the profession of pharmacy a few days earlier, was now willing to delay the administration of medicament to her daughter while she quibbled over the price.

Such situations are, of course, a matter of great concern to all of us. But they are even more important to you people because they represent a serious and growing trend: *The tendency to undervalue the practicing pharmacist in the community.*

Let's examine this situation. Out where I live, the entire community is very proud of the new fire engine, for which some $30,000 was spent. Even though the fire engine may go unused for months at a time, it is considered a wonderful investment in terms of insurance against disaster.

On the other hand, the pharmacy department of the drugstore near the firehouse provides an equally essential function, serving the typical family

*Presented at a convocation, Temple University College of Pharmacy, September 25, 1957.

only occasionally, but always ready to serve when needed. Unfortunately, *entirely too few members of the community share this view.* Is it the glamour of the engine's red paint—or have we done a poor job selling the true value of pharmacy?

How did we get into this position? And what can we do to reverse the trend?

To begin with, I think we must realize that the prestige of the community pharmacist has suffered because of several forces which have been at work for varying numbers of years.

In the first place, economic factors have forced pharmacists to expand into areas of service not directly related to prescriptions. Patent medicines were the first "sideline," and they were rapidly followed by such items as soaps, shaving equipment, and similar things of a personal nature. Later came such things as household disinfectants, deodorants, insect sprays, and other goods pertaining to health and cleanliness.

Suffice it to say that the ever-increasing size of the "front end" of a modern drugstore has obscured the view of the professional aspects of the prescription counter; the public too frequently thinks of the pharmacist more as a merchant than as a professional man.

Another factor is the enlightened public, which is being made more so by the 3,250,000 students in the United States colleges and universities. But back before this modern era, the people had an implicit confidence in pharmacy and in medicine which were mysterious to them. It was the alchemist who whispered into the king's ear, and, in primitive societies today, the witch doctor can still throw in a quarter of a dozen placebo-evil spirits and thus establish his prestige and value to the community. The people had respect for the vast number of unknowns in the treatment of the sick—and it's probably just as well, because then the answers just weren't available.

Today, the situation has changed. It is almost impossible to pick up a newspaper or magazine without finding at least one article about progress in medicine and pharmacy, and the treatment of ills is a standard topic of conversation among people of all levels of intelligence. But here is well-educated John Q. Public—with the highest degree of knowledge about his own health, fired by an insatiable curiosity in things pharmaceutical—being the first to downgrade our profession. *Familiarity has, in fact, bred contempt.*

In contrast, doctors have handled this situation rather well. They have repeatedly pointed out in printed material, as well as directly to their patients, that their diagnostic skill is an essential and irreplaceable part of therapeutic procedure. Because we in pharmacy are deprived of this particular argument, we now find ouselves bearing the brunt of the public's inconsistent sense of values.

What can we do to change all this? How can we regain the stature which is our rightful due as members of the medical care team?

As you know, some things are already being done. The American Foundation for Pharmaceutical Education is assisting finer young men and women to enter this profession. The Health Information Foundation has been effectively working through research to evaluate health needs of the community.

In the area of mass communications—newspapers, magazines, radio and television—the Health News Institute is disseminating material aimed at making the public more conscious of the professional services performed by pharmacists.

Unfortunately, the mass communication media, while essential in the re-education process, cannot do the job alone. There must be personal contact as well. Doctors in their offices make it routine to provide understanding and sympathy to their patients, and that same sort of personal professional service must be provided in the pharmacy if the profession is to enjoy public respect and confidence.

Yes, I realize the pitfalls involved here. You can't very well sympathize with Mrs. Jones when she presents a prescription for an antibiotic—it may very well be that she considers her infection none of your business, to say the least.

But with common sense, things can be done—and they must be done—at the retail pharmacy level. To begin with, persons entering the profession of pharmacy can make sure that they always conduct themselves as professional people—as ambassadors of their calling.

This, too, will occasionally involve the exercise of common sense, as in the case of the young doctor whose wife was driving him to the hospital one morning when an attractive woman waved at him.

"Who was that?" the wife wanted to know.

"Oh, just someone I got to ***know professionally,***" he replied.

There was a moment of silence. Then she asked: "Whose profession, yours or hers?"

But let's be serious for just a moment. I am sincere in my suggestion that young folks entering the field of pharmacy, whether in retail, wholesale, or manufacturing activity, dedicate themselves as ambassadors of their chosen profession. I suggest that you give this problem some thought; that you resolve to do your part, by influence upon others as well as through your own actions, to inspire in the general public a respect for pharmacy commensurate with its accomplishments.

As an ambassador, it is your day-by-day selling of the true value of pharmacy which will accomplish this end. It is easy for you to recognize situations where a small amount of influence will be of great value.

Tell your neighbor that each year medicines become more potent and that the pharmacist's personal responsibility becomes proportionately greater; *remind* him of the fact that those 2,000 medicines which must be carried are there for *him* should he contract anything from canker sores to carcinoma; *let him know* the pharmacist must learn drug potencies and dosages to act as a double check on the physician's prescription; *explain* that pharmacy encompasses a vast professional chain from researcher to manufacturer to wholesaler to pharmacist; *describe* with pride the nationwide professional service performed daily by our 53,000 drugstores working with 10,000 registered men in industry. These are things which inspired you to enter pharmacy—but don't take for granted your neighbor knows them—*he doesn't!*

Upon graduation, you will know more as a professional man than your predecessors; and, as a person, you will be better informed than they so that the broadness of a customer's experience with you will affect his esteem for you and your profession.

In the last analysis, we must trust the people's ability to perceive true value. I am reminded of the story they tell about the Italian master, Giotto. During the Renaissance, when so many great painters seemed to live at one time, the Pope sought to choose one to paint an important work for the Vatican. One after another, great masters received an audience and displayed their most beautiful, meaningful works. Then in came Giotto. The Pope was surprised. Giotto had no completed work with him. He thanked the Pope for the opportunity to show what he could do. And all he did was to draw a perfect circle—*free hand!* He got the commission.

So will the public come to realize true value in pharmacy, when we—you and I and all the other self-appointed ambassadors—start right now to draw its essential character for them.

Generally speaking, pharmacy will reward those who can and will think, who are sincerely interested in the jobs they now fill, and who are prepared to assume the responsibilities of leadership.

Robert A. Hardt, Am. J. Pharm. Ed., 4, 560 (1940)

THE PHARMACOGNOSIST'S CONTRIBUTION TO THE FIELD OF ALLERGY*

EDWARD P. CLAUS

Since his role has not been sufficiently publicized to medical groups, the pharmacognosist must assume the initiative in offering his scientific knowledge to medical practitioners in the field of allergy. From the viewpoint of interprofessional relations, the pharmacognosist has much to gain and little to lose if he approaches the allergist or the physician interested in allergy with a plan for collaboration of effort. To effect mutual cooperation, it is necessary for the pharmacognosist to indicate the potentialities of his educational background and the possibilities of research investigations in the common areas of the two fields.

By definition, that branch of medical science which deals with altered reaction is known as allergy; the materials which cause the abnormal effect are referred to as allergens. Allergens are chemical substances generally originating from plant or animal sources; however, the chemical structures of the individual substances have not at present been positively determined by laboratory investigators. Being of biological origin, some of these allergens have been a subject of study by pharmacognosists. Herein lies the relationship of pharmacognosy and allergy—notwithstanding the difference in their viewpoints, both sciences are concerned with a consideration of certain plant and animal materials. The allergist is interested primarily in diagnosing the condition, counteracting the effects of the allergens and relieving the symptoms of his patients; the pharmacognosist endeavors to recognize the allergen, if possible, and to study methods for its control. Regardless of the manner in which each accomplishes his objective, the ultimate result is an attempt to preserve or restore the normal health of the individual in particular and of the public in general.

Allergens are generally classified into at least five groups: (1) inhalants, (2) ingestants, (3) contactants, (4) injectants, and (5) infectants. It can be readily seen that biological matter is represented in each of these classifications. *Inhalants* include pollen grains, mold spores, dust particles, plant fibers, animal dander, bits of feathers, parts of insects, and similar substances sufficiently minute and light to be transported appreciable distances and in significant quantities by air currents. In fact, the term aerobiology has been applied to that type of biological matter contained in the atmosphere.

His laboratory training and technical skill with the microscope enables the pharmacognosist to identify many of these allergenic substances and to prognosticate their sources. Since the majority of airborne allergens are the etiologic agents in hayfever, seasonal pollinosis, perennial rhinitis and asthma, they are objects of attention by the allergist. Unless the physician has had unusual premedical preparation or unless he has served his internship in an allergy clinic, it is unlikely that he will have prior

*Presented on November 7, 1957 at the Section of Pharmacognosy, Phytochemistry and Botany of the Fourth Pan-American Congress of Pharmacy and Biochemistry, Washington, D.C., November 3 to 9, 1957.

knowledge of methods of identifying pollen grains, mold spores, and the miscellany of airborne particles. It is in this type of situation that the pharmacognosist can be of greatest service in corroborating the causative factors indicated by the case history, skin tests, sniff tests, or other means of identification employed by the physician.

Ingestants represent foods that are ingested or swallowed and commonly are responsible for symptoms involving gastrointestinal distress, hives, urticaria, edema and related conditions. The botanical and zoological relationships of certain foods often are overlooked by the general public when the allergist prescribes a restricted diet. Although some textbooks on allergy list the taxonomic relationships of plant foods, the information is not complete and should be supplemented by additional factual data. Who can do this better than the pharmacognosist whose training has undoubtedly embodied a study of biotaxonomy? An inclusive list of substances in related botanical families with the eliminated food marked appropriately is a necessity for the allergist to present to his patients. If, for instance, this table lists "cabbage" but omits "brussel sprouts" and the patient eats the latter, the purpose of the elimination diet has been defeated since the same allergen occurs in both of these foods. Similarly, if the patient is warned not to eat tomatoes but no mention is made of eggplant, it may be that the physician's efforts are wasted. The pharmacognosist can indicate such relationships through his botanical background. Of course, he must bring his knowledge to the attention of the allergist to accomplish this result.

Contactants cause much suffering and discomfort in hypersensitive individuals. Many allergens possess the particular characteristics which elicit symptoms of urticaria, erythema, pruritis, and edema. Notwithstanding the broad coverage given by the press, by medical and pharmaceutical advertising, and by group discussions and lectures, it is surprising to learn of the numerous people who cannot recognize the poison ivy plant, *Rhus radicans* L. Many physicians recognize the published photographs of the trifoliate leaves, but they are unable to determine the identity of the plants in their native habitat. The pharmacognosist cannot only teach identification but also, and this is infinitely more significant, he can familiarize both patient and physician with eradication procedures for these and other weeds. Since many additional plant substances evoke corresponding symptoms, he can disclose their similarities to or differences from poison ivy. Southern poison oak, poison sumac, and other members of the sumac family (*Anacardiaceae*), poinsettia, snow-on-the-mountain, and related members of the spurge family (*Euphorbiaceae*) as well as countless other plants have been shown to possess allergenic properties when they touch the human epidermis. Of practical significance is the knowledge of extermination procedures to prevent further contacts.

Injectants, allergens which produce their ill effects when they are introduced by parenteral means, are also indicative of specific antigenic substances in plant and animal matter. It is undoubtedly not the penicillin molecule which produces the allergic response but the impurities that contaminate the antibiotic. When a nonallergic individual is stung by a bee or a hornet, the response is painful but relatively fleeting; but when a hypersensitive person is the recipient of an insect sting or bite, the syndrome is almost

catastrophic, frequently to the point of death. The pharmacognosist may effectively aid the general public through teaching students and lay groups that the injectable venom of insects may cause symptoms sufficiently severe to warrant an emergency trip to the physician. Furthermore, he can counsel pharmacists and pharmaceutical groups to appreciate the seriousness of the untoward effects caused by liver extracts, antitoxins, vaccines, and other injectables of animal origin. If the pharmacist is made aware of the implications of itching toes and hands, erythematous skin and nervous irritability, he may be able to prevent serious complications to the patient by referring him back to his physician immediately or perhaps, in dire emergencies, by cooperating with the physician in administering the necessary control measures as directed by the physician through the medium of the telephone.

Infectants represent those biological organisms which, although capable of producing a disease condition, may give rise to allergic responses in some individuals. Often a case of sinusitis may be traced to the presence of bacteria in the patient's body usually in the form of a chronic infection. In such instances the human becomes sensitized to certain bacterial products which, because they are continually being formed, represent a constant source of allergenic matter. The pharmacognosist cannot, in any appreciable degree, aid the allergist in these cases except by knowing that such situations do occur and consequently by disseminating the information among students, colleagues, and pharmacists.

If the pharmacognosist has been interested chiefly in the biological phase of his subject, he has acquired a certain degree of proficiency in the recognition of plants as they grow in their native habitats. Often such knowledge can be put to good use in verifying the suspected presence of unusual atmospheric pollens. Most technicians who perform pollen counts for allergists have had little or no training in plant identification. If they should observe ragweed-like pollen grains on atmospheric slides exposed during May or June, they undoubtedly would be instructed that ragweed plants do not flower at that time. When they next see such pollens on a slide, they will either ignore their presence or label them as "unidentifiable." In such cases it is possible that an important allergen is thus disregarded.

For example, it has been noted that in northeastern United States the fleabane plants, *Erigeron canadensis* L., blossom in June and shed pollen grains similar to those of the ragweed, *Ambrosia trifida* L. No substantiation of any allergenic similarity has been attempted as yet through the use of pollen extracts and the subsequent skin tests. It is quite possible that fleabane pollens may be a cause of that type of hayfever that occurs during the grass pollen season but is not attributable to the grasses. Although this and similar situations may represent isolated causes of hayfever, such investigations will constitute a step in determining the etiology and in supplying more complete data on hayfever causes. Because of his practical field identification experience, the pharmacognosist can be of inestimable value in collaborating with the allergist in ascertaining the problem of unsolved hayfever cases.

Pollen counts are extremely important in the compilation of data for national surveys. With his experience in microscopical detail, the pharmacognosist is ideally prepared for identifying the aerobiologic matter of allergenic significance. Since this type of investigation falls within the

scope of his professional activities, the pharmacognosist should have a natural interest in helping to solve this problem. Verification of the identity of pollens found on atmospheric slides can be accomplished by comparison with known samples collected from flowering plants growing in the vicinity.

If the pharmacognosist has specialized in phytochemical extractions, he may be interested in detecting the specific chemical agent responsible for antigenic activity. Although considerable research has been expended in this field, the results are far from complete. Better extracting fluids, improved extraction methods, more effective chromatographic determinations, and diverse supplementary attempts will add much to the present state of accumulated data on the antigenic fraction of pollens, molds, dusts, foods, and analagous allergens. The pharmacognosist who possesses an adequate knowledge of these procedures should definitely approach the allergist with an offer of assistance. This field is in urgent need of investigators, and cooperation between pharmacognosist and allergist is assured if contact can be established.

The growth of mold cultures in the laboratory enables the allergist to substantiate the presence of certain fungal spores in the atmosphere. The inherent ability of the pharmacognosist to culture bacteria and fungi is of particular value in determining the identity of molds of importance in allergy. The maintenance of suitable stock cultures for reference is an essential part of this investigative problem.

The pharmacognosist, in maintaining a close liaison with the allergist, may offer his cooperation in determining the causes and in discovering new sources of allergens. If he prepares a collecton of permanent microscopic mounts of aerobiologic matter, he may be called upon to verify doubtful identifications. If he creates a rather complete culture collection of fungi, he will be asked to discuss and exhibit these at professional meetings. If he is proficient in botanical identification, he may organize field trips specifically for instruction in the recognition of allergenic plants.

If he is engaged in the teaching profession, the pharmacognosist should call his students' attention to the subject of allergy, to pollen counting methods, to the means of acquainting patrons of the retail pharmacy with information about allergic implications and the advisability of seeing a physician. As a faculty member, he probably is requested to appear before pharmaceutical groups to speak on subjects of his choice. In this way he can indicate to practicing pharmacists the hazards to the patient's state of health when allergic reactions are permitted to go untreated. He can also inform the pharmacist of the ways in which he can assist both allergist and patient by emphasizing the physician's advice to his patient.

If he invites allergists to conduct the meetings of their societies at his school or in his laboratory, the pharmacognosist can establish a reciprocal relationship which may result in his being asked to appear at their meetings. He will gain much by extending individual invitations to allergists and to physicians interested in allergy to speak before his classes, before pharmaceutical organizations and at professional seminars. Mutual understanding of their respective problems results from such meetings of pharmacists and physicians. The pharmacognosist can accomplish much in increasing his professional stature if he is instrumental in developing better interprofessional relations among his colleagues in pharmacy and medicine. As an

outgrowth of all these activities it is to be expected that the general well being of the allergic patient will be considerably improved and that empiricism might be completely removed from the remedial measures presently employed in the treatment of allergic cases.

More than ever before, the pharmacognosist has the opportunity to translate his broad education, training, and experience into something tangible. Plant and animal drugs, subject matter of major interest in pharmacognosy for years, have largely been supplanted by chemical entities. In this day of specific medicine, such replacements are inevitable. At present, allergens are not identifiable chemically; no doubt, at some future time, their chemical structures will be resolved. Until that time, the pharmacognosist, to improve his professional integrity, can secure his position in the health professions by utilizing his knowledge to the fullest extent. One important avenue for better recognition is to contribute his mental and physical resources to practitioners in the field of allergy.

The badges of honorary societies represent talent, ability, stern intellectual honesty, a desire and a capacity to advance, as individuals and as representatives in fields of vital human progress.

Rudolph A. Kuever, Am. J. Pharm. Ed., 7, 49 (1943)

A REPORT ON FIFTH YEAR STUDENTS AS "CONSULTANTS IN DRUGS"

GORDON H. BRYAN AND JACK E. ORR

In recent years pharmaceutical educators have been referring more and more to the increasing importance of the pharmacist as an adviser to the physician on medicinals. The necessity for adequate preparation of the pharmacist for this growing responsibility has been cited by many as one of the reasons for extending the program of study to five years. If the pharmacist is to maintain and develop further his professional standing he must be able to provide a service to the medical and allied professions as a "consultant in drugs."

According to a recent report (1), 487 new prescription pharmaceuticals appeared on the market in 1957. To this may be added nearly 200 new doseforms, new potencies, formula changes, and new packages. From this it is obvious that the physician is in need of a service which can be supplied only by the pharmacist—that of sifting through this maze of new products and giving him impartial advice.

In the colleges of pharmacy we are attempting to prepare our students to assume this duty by increasing the emphasis in pharmacology and related basic biological sciences, in organic medicinal products, and elsewhere. All concerned must realize that the training of the pharmacist differs from that of the physician in that it is drug-oriented rather than disease-oriented. In other words, the primary functions of the pharmacist, both practically and ethically, are compounding and drug action and not diagnosis or treatment.

The merits of a consultant role for the pharmacist have been well stated (2) and are generally assumed as worthy. Proceeding on this assumption it was of interest to learn how the educational program is meeting the challenge. Therefore a laboratory demonstration was undertaken in the spring of 1953 as a project of the class in pharmacology. The resident physician at the Student Health Service was asked to take part in the trial run and readily agreed. The students were then asked to prepare discussions on individual drugs or groups of drugs for presentation to the physician and interviews were arranged. Prior to the interview, however, each student made his presentation before the class, at which time other members of the class were asked to criticize. This subsequently proved to be the most arduous phase of the entire program for the student, who soon found that his classmates were far less sympathetic than the physician. Comments and suggestions were also added by the instructor. Then, after polishing up his presentation, the student was permitted to follow through with his interview. Afterwards he reported his experience to the class.

The results were so encouraging to student, instructor, and physician alike that it was decided, in 1954, to expand the program to include physicians in Missoula and the following letter was sent to a selected group which included both specialists and general practitioners:

Dear Dr. Doe:

During the Spring of 1953, members of the senior class in pharmacology at the School of Pharmacy were permitted to "detail" a drug to the physician in charge of the Student Health Service. The results exceeded our expectations and have encouraged us to attempt an extension of the program.

The plan is based upon the premise that it is the practicing pharmacist who should be best able to provide a desirable service as a "consultant in drugs." This service is predicated on his having and maintaining complete pharmacological information on the drugs used in clinical practice, both of specialty items produced by the manufacturer and of official preparations. He also has a comparative knowledge of similar compounds produced by different manufacturers.

In no sense is this project to be considered as a training school for future manufacturers' representatives, but rather as an introduction: (1) to the student, of the things a practicing physician is most interested in knowing about drugs, specifically or generally, and (2) to the physician, of the capabilities of the potential pharmacist in supplying this information.

We would like to request ten minutes out of your very busy schedule during the coming two quarters for a pharmacy student to detail a drug or group of drugs to you. Arrangements will be made at your convenience, of course.

We are enclosing a self-addressed card which we are asking you to check for: (1) your permission, and (2) the topic you would be most interested in having presented (either a single preparation or a comparative group of drugs).

Very truly yours,

The return post card which was enclosed consisted of two questions worded as follows:

(1) I (am) (am not) willing to have a pharmacy student "detail" a drug or group of drugs to me.

(2) I would be most interested in hearing about:

_____

(single preparation or comparative group of drugs)

_____

Signature

Favorable responses were received from all seventeen of the physicians contacted. The topics requested were quite varied, ranging from single drugs such as procaine amide to broad topics such as vitamin D and calcium therapy, and from the popular items of the day such as the tranquilizers to older drugs like digitalis.

The members of the class were assigned topics and were then directed to begin their preparation. The most widely used sources of information were the textbook (3), manufacturers' literature, and journals. The same procedure as described above was followed, i.e., the student gave his presentation before the class and smoothed out the rough spots before calling on the physician. The time spent in preparation ranged from two hours to thirty hours (average, eleven). It is interesting to note that after the interviews nearly one-fourth of the group felt the time spent in preparation was inadequate.

Each student was given the responsibility of arranging an appointment with the physician of his choice. Such appointments were made two days in advance, on the average, although some students made no appointment ahead of time. More frequently than not the young "detail man" found himself waiting his turn with an office full of patients for varying lengths of time. This is the normal situation, as any manufacturer's representative will attest. Rather surprisingly, the average wait was only eight minutes for the 1957 class. Each of the students reported a cordial reception by the physician.

If he were discussing a single drug, the student spent the first five minutes of the interview making his presentation and then invited questions. Where an entire class of preparations had been requested, the interviewer usually stated that he was prepared to answer questions about that class and invited the physician to ask them. Experience showed that questions were readily forthcoming in either case.

The volume of questions asked and the intensity of interest displayed by the physician appeared to be influenced by whether or not he currently had a patient under treatment for an ailment in which the drug or drugs are recommended. The students were usually able to answer most of the questions satisfactorily, although some reported having to reply "I don't know" on occasion. For the most part questions were in regard to pharmacodynamics, toxicities, therapeutics, dosage forms, supply, and price.

Each student was also instructed to inquire of the physician what services his pharmacist provides him with and what services he desires. Most frequently physicians indicated the primary service to be one of supply. Some expressed an appreciation of the check provided by the pharmacist in discovering overdoses or incorrect dosages. A majority volunteered the opinion that they depended upon the pharmacist for product information beyond that received from manufacturers' representatives. These were the chief services expected of and received from their pharmacists.

Often, following the discussion of the main topic, the interview relaxed into an informal discussion which was apparently enjoyed by the busy physicians.

The average length of interview turned out to be about twenty-five minutes although only ten minutes had been requested. Fifteen minutes was the most frequently reported time. Some students said that they tried to remind the physician that they were overstaying their allotted time, but that the physician insisted on continuing the interview. The minimum time spent was five minutes and the maximum about ninety minutes.

At the next class period following his interview the student was asked to spend ten or fifteen minutes relating his experiences and making suggestions for the benefit of his classmates.

The students have all agreed that the experience was extremely valuable in that they have lost their apprehension (most reported slight to moderate nervousness before the interviews) about talking with physicians. The 1957 class was asked to state in what ways they felt their educational background was inadequate. Half of the group believed it to be adequate. The rest expressed opinions that their most notable deficiencies were in medical terminology, the ability to communicate, and experience.

The program has been in operation for five years with most of the original physicians and a few new ones taking part. Verbal comments and opinions by each participating physician indicate three levels of student performance:

1. Superior. Exceeding or comparable to that given by the professional detail man.
2. Average. Informative and competent, but hampered by inexperience.
3. Inferior. Brought about by factors of a personal nature as well as those indicated by the students themselves.

Approximately 10 per cent of the students were rated in class 1, 75 per cent in class 2, and 15 per cent in class 3.

Since the program is continuing, it is apparent that it is deemed successful and useful at this institution and that fifth year students have the background to perform the service and broaden the concept should they choose to do so.

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The only thing that will keep us free is an intelligent discipline imposed and accepted in the common interest, with as much of it voluntary as the peace and dignity of the Commonwealth permits.

Curtis Bok, Am. J. Pharm. Ed., 7, 288 (1943)

THE OUTPATIENT PHARMACY AS AN IN VIVO PRESCRIPTION LABORATORY FOR PHARMACY STUDENTS

HAROLD J. HAMILTON, LOUISE POPE, AND WILLIAM M. HELLER

The desirability of, and methods by which, schools of pharmacy might provide more "practical" experience in dispensing has often been discussed by educators (1-8). Methods of approach include bringing actual prescriptions into the dispensing laboratory or model pharmacy (1-3), and conversely, taking the student to the prescription (4-8). While the former approach is probably used by almost all teachers of dispensing, the latter attack is still largely undeveloped.

One of the most notable attempts by a school of pharmacy in this country to bridge the gap between theoretical and practical pharmacy was the ill-fated Washington Experiment conducted by Professor L. Wait Rising at the University of Washington in the middle 1940's. In the Washington Plan selected professional pharmacies were used as the laboratories for a portion of the students' training during one quarter of their senior year. That this program was popular with retail pharmacists is attested by a resolution passed by the Washington State Pharmaceutical Association in July, 1945, commending the program (2).

The boom was lowered by the American Association of Colleges of Pharmacy and the American Council on Pharmaceutical Education. It was pointed out that Bylaw I 8 (e) of the AACP was being violated if the store work was not under the direct supervision of a faculty member: "No undergraduate credit shall be given for work in pharmacy taken as an extension course, by correspondence or in any other way than in residence." (2) Meeting in Philadelphia in 1945 the ACPE stated: "Since the practical experience requirement has been one of the legal requirements for licensure and not for graduation from a college of pharmacy, and for other reasons the American Council on Pharmaceutical Education, pending further investigation, will not approve the granting of college credit in a four year curriculum for practical work done in drugstores." (2)

An increasing number of schools of pharmacy in this country are becoming affiliated with health science centers in which one of the components is a teaching hospital. Several of these institutions provide practical experience in hospital pharmacy practice (9-13). Dean Zopf (5) has outlined the program in hospital dispensing conducted at the State University of Iowa. McConnell (14) and Superstine (15) have presented different aspects of the program at the University of Michigan. By giving faculty appointments to members of the hospital pharmacy staff, the requirements of the AACP and the ACPE are met.

UNIVERSITY OF ARKANSAS

The University of Arkansas Medical Center is composed of Schools of Pharmacy, Nursing, and Medicine, the University Hospital and Clinics. Some 100,000 patient visits per year are made to the emergency room and

clinics, and the outpatient pharmacy averages 240 prescriptions daily. The medication dispensed in the outpatient pharmacy is typical of that dispensed to ambulatory patients of hospitals, clinics, and community pharmacies.

In this setting we have designed a course in prescription practice. Actually, it is planned to be an extension of the laboratory work in dispensing and, as such, is of value to all pharmacy students. There is no calculated attempt to indoctrinate the students into hospital pharmacy practices. Our objective is to give the students an opportunity to practice dispensing pharmacy *in vivo,* although still under supervision. The physical surroundings and the procedures used in the outpatient pharmacy emphasize the highest professional approach to prescription practice and demonstrate to the students that the ideals learned in the classroom need not be sacrificed in practice.

Prescription Practice is a one credit-hour, three clock-hours course required during the last semester of students on the four year program and during the last two semesters for students on the five year program. One semester of dispensing is a prerequisite.

Physically, the outpatient pharmacy is nineteen feet by twenty-five feet and contains the usual prescription compounding equipment: a refrigerator, safe, desk, files, cash register, typewriters, both open and closed shelving for drugs, and a long prescription work counter with sink (see figure). Five students and two supervisors are the maximum number of people who can function effectively in this area. This happens also to be the maximum number who can be kept busy on our average of 240 prescriptions daily. Two of the students are assigned to typing labels, two to filling prescriptions, one to receiving and dispensing the prescriptions and acting as cashier.

While one supervisor can ensure the safety of all items dispensed, an additional supervisor is needed to permit time for discussions with the students, thus providing more effective teaching.

For the student to function and learn effectively in this situation, he needs to know what is expected of him. The course is introduced with two lectures designed to orient the student into the course and the environment in which it is conducted. Topics covered include: the place and functions of the Pharmacy Service in the Medical Center, the formularly system, policies and procedures of the outpatient pharmacy, and the activities and concepts expected of the student in this course.

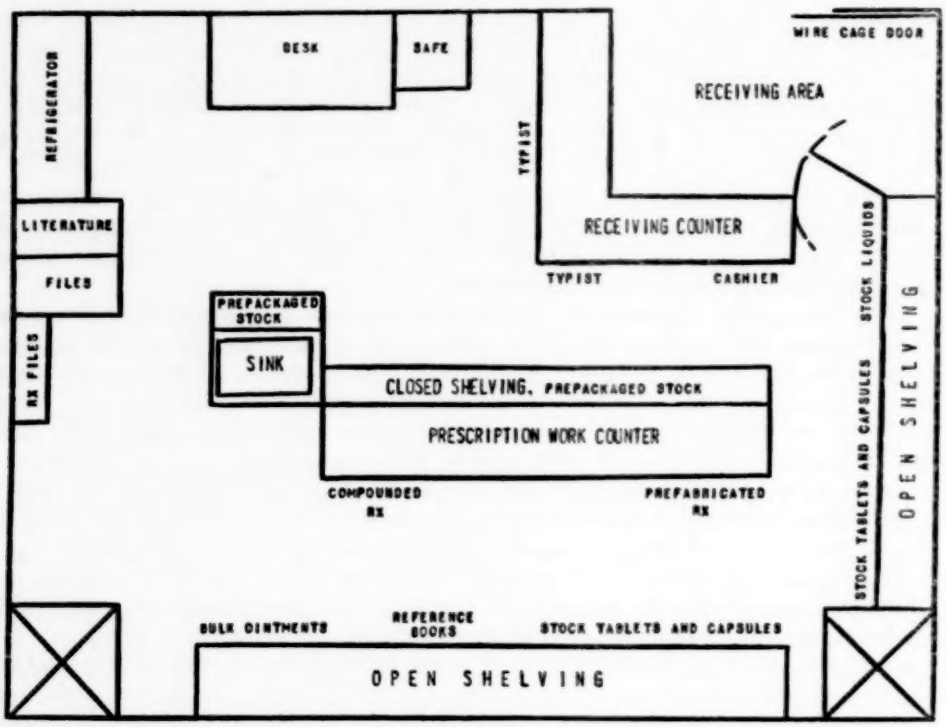
So that both student and supervisor know what accomplishments and concepts are to be included, each student is given a check sheet (Addendum A) to be kept in his notebook. The check sheets have been adapted from those in the "Experience Record for Hospital Pharmacy Internship or Residency" by Lantos and Flack (16). It is the responsibility of the student to see that he accomplishes these activities and discusses these ideas, and it is his responsibility to secure the initials of the supervisor acknowledging same.

A few brief comments on certain points are in order. In Activity 2 the great majority of prescriptions filled by students are Formulary prescriptions, not prepackaged. While we ordinarily operate like a typical outpatient pharmacy, with 98 per cent of our prescriptions precompounded and 75 per cent prepackaged, the students must count and pour and compound each prescription individually. Prepackaged prescriptions are used only for a brief time to give the student some experience in this phase.

UNIVERSITY OF ARKANSAS MEDICAL CENTER

OUTPATIENT PHARMACY

CLINIC WAITING ROOM



SCALE: $\frac{1}{4}$" = 1'

LOCATION: FIRST FLOOR, AT THE ENTRANCE TO THE CLINIC LOBBY.

FACILITIES: HOT AND COLD WATER, ELECTRICITY, AIR CONDITIONED, PNEUMATIC TUBE SYSTEM

Another change from our usual method of operation is involved in Activity 5. Ordinarily, we accept no oral prescriptions. However, we are developing this activity to give both pharmacy and medical students experience in telephone prescriptions.

The thought behind Activity 7 is to give the student an idea of the drugs and supplies used in a physician's office.

Activity 8. The work sheets are the same as those used in the dispensing laboratory.

While the propriety of including Activity 9 in a course in prescription practice is moot, it is easily accomplished and appears to be of some value to most students.

Activity 10: Although nothing is dispensed with a prescription, we do dispense on prescription, many of the so-called prescription accessories.

The Rating Form (Addendum B) is also adapted from the "Experience Record for Hospital Pharmacy Internship or Residency." (16) It is diffi-

cult to rate students in this type of course, but we believe their attitudes and personal relationships are the most important factors. This is one of the few courses in the pharmacy curriculum where such factors can play a major part in rating the student, and it is to his advantage to be made aware of the opinion of others in his profession before he becomes dependent on these opinions for his livelihood. Note that he is rated against practicing pharmacists, not against his fellow students. (Most students have regarded this as an advantage.)

POSSIBLE PROBLEM AREAS

That there are in this country several universities containing both a school of pharmacy and a teaching hospital, yet having no program for "practical" experience for pharmacy students (17) is indicative of the fact that there are difficulties in such programs. As might be expected, most of these problems involve the compromises which must be made between the educational program and the service functions of the hospital pharmacy.

The first decision is to define the course. Is it to be simply prescription practice, an extension of the dispensing laboratory, useful to all pharmacy students, as we have described here? Or should there be a greater emphasis on retail pharmacy practices, de-emphasizing the hospital atmosphere and making a greater effort to simulate the retail environment? If so, how far should the effort extend? Just prescriptions? Prescription accessories? Over-the-counter medication? Gift shop? Soda fountain? Snack Bar? Flower shop? After all, many of these activities are already carried on in hospitals.

Assuming that the decision is to teach professional practices only, there are still many problems involved. There must be adequate numbers of supervisors. The supervisors must be better than average pharmacists, for two reasons: firstly, to attain and retain the respect of the students; and, secondly, to protect the patients from the increased likelihood of mistakes. Salaries usually paid hospital pharmacists may not be adequate to secure these superior pharmacists.

The specialized-function, or assembly-line system, used in prescription filling in the busier outpatient pharmacies, in which everyone is checked and double-checked, may conflict with the every-man-for-himself don't-look-at-what-your-neighbor-is-doing philosophy of the dispensing laboratory.

The prescription pricing system and/or schedule used in the outpatient pharmacy must be defensible.

The use of the Formulary System, standard practice in more than half the hospitals in the United States (18), may present problems. Admittedly, there will be fewer combinations and duplicate drugs and consequently fewer trade names in use. Some may even maintain that you are teaching the student "unethical and illegal substitution."

We hope we have stimulated your thoughts by outlining the program planned at the University of Arkansas Medical Center to help bridge the gap between theoretical and practical pharmacy. Undeniably, there are many and serious problems. Why then, you may ask, go to all the bother? We would remind you simply that one of the characteristics of a profession is that the practitioners of the profession play a part in the education and training of the students of that profession.

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ADDENDUM A

The student is to engage in the following activities under supervision of an Arkansas registered pharmacist who is on the Faculty of the School of Pharmacy:

1. Control of Narcotics
   - A. Receipt and Proper recording of these drugs:
     - Date (s) Accomplished
     - Checked By Supervisor
   - B. Dispensing of these drugs to patients:
     - Date (s) Accomplished
     - Checked By Supervisor
   - C. Inventory of these drugs at close of dispensing period:
     - Date (s) Accomplished
     - Checked By Supervisor
2. Dispensing and processing of prescriptions:
   - A. The Non-Formulary prescription:
     - Date (s) Accomplished
     - Checked By Supervisor
   - B. The Formulary prescription, not prepackaged:
     - Date (s) Accomplished
     - Checked By Supervisor
   - C. The Formulary prescription, prepackaged:
     - Date (s) Accomplished
     - Checked By Supervisor

3. Review the prices charged on 25 prescriptions for different items and, with the aid of standard pricing schedules, compare the prices with proposed retail prices.

   Date (s) Accomplished
   Checked By Supervisor

4. Take a rapidly formed line of five or more persons, waiting to present their prescriptions, and satisfy their requirements rapidly by one or more methods, ending with the patients on their way with a filled prescription or waiting peacefully for their prescription to be filled.

   Date (s) Accomplished
   Checked By Supervisor

5. Receive and record with accuracy and speed prescriptions given over the telephone.

   Date (s) Accomplished
   Checked By Supervisor

6. Tactfully and successfully handle prescription problems with the medical staff (omission of part of Rx; confirming dosage; obvious errors, etc.) and issue information on drugs to the medical and nursing staffs by means of:
   A. Personal conferences in the Outpatient Pharmacy:

      Date (s) Accomplished
      Checked By Supervisor

   B. Telephone conferences:

      Date (s) Accomplished
      Checked By Supervisor

7. Accomplish at least one monthly check of drug supplies in at least three clinic nursing stations.

   Date (s) Accomplished
   Checked By Supervisor

8. Emphasize and facilitate activities 1 through 7 completing Work Sheets for drugs appearing in prescriptions which the student has processed. Two to four such Work Sheets, as assigned by the supervisor are to be turned in at the end of each class period. Assignments will be based on:
   A. Relative importance of the product.
   B. Apparent lack of thorough knowledge of the product.

   Date (s) Accomplished
   Checked By Supervisor

9. Close out of cash register and preparation of daily report.

   Date (s) Accomplished
   Checked By Supervisor

10. Explain to patients (and staff) the proper procedures and precautions for using the various so-called prescription accessory items which are prescribed.

In addition to the foregoing check list of typical activities which can be pinpointed, the student is responsible for the following concepts & accomplishments:

Supervisor's Initial

———— 11. Accuracy in prescription compounding.

———— 12. Labeling problems, including patient directions and identification of patients.

———————13. Types of containers to be used for prescriptions and stock.
———————14. Scope of standard stock and its determination.
———————15. Stock arrangement and stock reserves.
———————16. Problems of the extemporaneously compounded prescription in the busy pharmacy.
———————17. Permanency of individual items of stock and problems involved.
———————18. Trend analysis as applied to therapy, type of illness, economic levels of patients, etc.
———————19. Control of stock by accounting procedures (inventory) and control of revenue.
———————20. Maintenance of appearance and cleanliness of the Pharmacy.
———————21. Student and personnel attitudes and their effect on patients.
———————22. Student attitudes and their effect on personnel.
———————23. Relations and mutual problems encountered with community welfare agencies supplying medical aid.
———————24. Problems involved with clinical rate-downs for indigent patients; relative community costs and competitive influences.
———————25. Policy concerning refilling of prescriptions.
———————26. Policy concerning over-the-counter sales of drugs.
———————27. Policy concerning drugs issued to hospital personnel, students, and the medical staff.

ADDENDUM B

Student ———————— Year, Semester ———— No. of Hours————
Instructions to supervisor: consider that the student is being compared to a typical representative group of practicing pharmacists. In this typical group it has been stated that 7 per cent would be "outstanding," 24 per cent would be "good," or "above average," 38 per cent would be "fair" or "average," and would represent the greatest proportion of pharmacists, and 31 per cent would be "below average" to "poor" to "unsatisfactory." Use the characteristics listed to *assist* in determining the rating.

1. His knowledge of the pharmacy activity and of the experience to be accomplished and his record of attaining same.

———————————————

A. Knows all concepts and activities on check sheets; takes the initiative in accomplishing these activities and obtaining supervisor's acknowledgement; seeks out additional possible areas of experience.
B. Well acquainted with the concepts and activities on check sheets; usually takes the initiative in accomplishing these activities and obtaining the supervisor's acknowledgement.
C. Usually remembers the concepts and activities on check sheets; usually brings them promptly to the attention of the supervisor.
D. Sometimes forgets the concepts and activities to be accomplished; sometimes forgets to bring notebooks, etc.; hesitates to discuss the concepts listed.

F. Often forgets notebook; seldom has activities recorded; reluctant to discuss the concepts listed.

2. His work sheet. _____

A. Complete; accurate; neat; on time.
B. Lacking in one of the above.
C. Lacking in two of the above.
D. Lacking in three of the above.
F. Incomplete; inaccurate; untidy; late.

3. His work proficiency (consider work habits, attitude, ability, competence). _____

A. Quality of work is excellent; uses very good judgment; expresses ideas in a clear, understandable manner; extremely conscientious and resourceful.
B. Can be relied upon to turn in consistently good performance; his ideas can be followed without difficulty; can usually be depended upon to exercise care; a hard worker.
C. Work is satisfactory and proficiency average; ideas well enough organized to allow understanding; applies himself moderately well to his work; is moderately resourceful.
D. Somewhat lacking in professional proficiency; inclined to jump to conclusions; some difficulty in expressing himself clearly; not quite careful about his work as he might be.
F. Lacking in professional proficiency; inclined to jump to conclusions; difficulty in expressing himself clearly; not careful about his work as he might be.

4. His relationships with personnel (ability to get along with others). _____

A. Very much liked by associates; exceptionally tactful; does any task gladly; welcomes criticism and suggestions and takes appropriate action.
B. Well liked by associates; knows how to be tactful; is usually ready to pitch in and help if needed; takes criticism and suggestions gracefully and tries to modify behavior accordingly.
C. Gets along well with others most of the time; liked by associates; tries to be tactful; listens politely to criticism; may or may not act upon suggestions.
D. Wants to do things his own way more often than is desirable; disliked by some associates.
F. Somewhat lacking in tact; becomes sullen when criticized; tends to react negatively to suggestions; or worse.

5. His relationship with the public. _____

A Commands respect of the public; exceptionally tactful, courteous and helpful, even to the most cantankerous patients; never shows irritation.

B. Gains respect of the public; knows how to be tactful and courteous; always tries to be helpful to patients; controls irritation.
C. Generally respected by the public; generally tactful, courteous; helpful to patients; seldom shows irritation.
D. Sometimes unable to gain confidence of patient; sometimes untactful.
F. Has difficulty gaining confidence of patients; sometimes untactful; occasionally discourteous; or worse.

6. His personal adjustment (emotional stability and maturity).

_____

A. Shows no signs of nervousness; relatively free of mannerisms; does not get annoyed or rattled easily; goals are completely in harmony with abilities.
B. Seldom shows signs of nervousness; seldom gets his feelings hurt or shows annoyance; recognizes most of his limitations.
C. Appears to be fairly stable and well adjusted; tries to avoid emotional reactions to problems and usually succeeds; tries to adjust his goals to his abilities.
D. Inclined to be nervous, irritable, and easily annoyed; inclined to get feelings hurt.
F. Has little insight regarding personal limitations; or worse.

7. His care of property and materials.

_____

A. Area and equipment are *always* clean; orderly; in good repair (or supervisor has been notified of need for repair).
B. Area and equipment are *almost always* clean; orderly; in good repair (or supervisor has been notified of need for repair).
C. Area and equipment are *generally* clean; orderly; in good repair (or supervisor has been notified of need for repair).
D. Area and equipment are *often not* clean; orderly; in good repair (nor has supervisor been notified of need for repair).
F. Area and equipment are *usually not* clean; orderly; in good repair (nor has supervisor been notified of need for repair).

Signed by _____
Supervisor

Pliny, speaking of the physicians of his day, remarked that they knew neither the names of drugs nor how to compound them. . . .

Michael Ginsburg, Am. J. Pharm. Ed., 6, 9 (1942)

FUNDAMENTALS FOR PROFESSIONAL MANAGEMENT

FRANKLIN S. WILLIAMS

Today we emphasize professionalism. As members of a profession and of a professional association we unite to establish, maintain, and improve standards. We act to keep our members up to such standards, and to inform the public so that it, too, may appreciate these standards and even insist on them. And we act to protect the general public and our professional associates from those individuals, who for some reason, do not follow the standards on which we have mutually agreed.

I should like to discuss with you the content of our courses which propose to train those persons who will become the professional pharmacists and the professional pharmacy managers of the future. This is indeed a matter of importance to all of us, I believe, because many of our graduates later face the many responsibilities of the executive—the business manager, if you like—as well as those of the professional pharmacist. These pharmacy managers cannot wholly separate this dual set of responsibilities. Neither can they expect the public to accept them as truly professional men if they discharge one kind of responsibility effectively while failing to meet adequate standards in regard to the other. Eventually the man who serves the public must reveal many of his individual characteristics to them. How, then, can he be considered a professional pharmacist manager if he is a professional pharmacist and only a business mechanic?

The course in pharmacy management, as now outlined, is directed towards some valuable objectives. I include the prescribed course content—as presented in the currently accepted text in the field (and capably handled, I might add)—in the management course I teach, for I believe the manager must know these things. He must know how to choose a location, buy assets, hire personnel, set up budgets. He must finance his business so that his liquidity permits him to continue operation. He must direct his attention towards sales promotion, store layout, inventory control, and the purchasing, receiving, marking, and pricing of merchandise.

Suppose, however, we have taught a man all of these things, and four years later we find him in his first manager's job. He complains about being short of personnel. He is overworked. He simply cannot get the work out, and no one seems to help him. He says he can't supervise for working, that the store is really going to the dogs if something doesn't happen. Don't we have some smart young pharmacist to send him, a "fireball" who can really get the work out?

Perhaps an examination shows, however, that our overworked manager frequently has extra time and slack periods when he could do some organizing and planning, could better arrange some of the details of his job. But when he does have the time, he doesn't use it for this. He is cleaning, marking stock, rearranging displays, or shuffling invoices. He gets involved in many unimportant clerical jobs, and his work is always pushing him.

What must the manager trainee know in order to better perform the functions demanded of him? Admittedly in every store someone must

perform the operational routines of buying, selling, marking, pricing, inventorying, and record-keeping. The manager must know these things need to be done, and he should understand how to do them. But before that, he must have a pretty definite idea of just what is the goal of the firm—or what are the goals or objectives of his pharmacy.

He must, then, have a fairly comprehensive grasp of just how all the activities of the firm should be integrated into one smoothly working, efficiently functioning whole. What must be done? When? For this, he must understand the function of planning. Now we are getting down to an investigation of the administrative functions of the manager. Planning may be described as deciding in advance what is to be done. The man who does not plan very well is the man who is faced too often with unexpected crises and emergencies which could have been mitigated or even avoided if he had done adequate planning. If, instead, the manager continues to improvise, to play by ear, he is likely to find that an accomplished, integrated production is impossible. Managing a retail pharmacy is not like playing a single instrument but, in fact, is more like acting as the head of an entire orchestra. Somehow the different instruments do not play together consistently unless they have a central, unified theme to follow. And the musical score of the orchestra functions as the plans of the manager—it provides a predetermined procedure which, if followed, will act to unite the many activities of the enterprise.

How does a manager make plans? What kinds are necessary under varying conditions? What, for instance, can be gained by the use of standard operating procedures? In attacking a problem, how can he more effectively decide between alternatives? How should he weigh measurable versus intangible factors? What strategic considerations are to be taken into account when planning? How far can the function of planning be delegated to subordinates? Planning functions to economize the effort and time of both manager and managed. If we are to have efficiency in the firm, the function of planning will be a key factor in its attainment. We must explore this area in our management training.

A manager must also assemble resources—men and capital assets—in order to produce the goods and services which the firm is designed to offer. Here the usual text offers more complete information. But how can the manager best balance the relative amounts of resources which he utilizes? What principles should guide him in the proper combinations of man hours, advertising space, and departmental space areas? It seems to me that here we can investigate the concept of least cost combinations, as discussed in advanced economic theory (1). It is here that the engineer and the economic theorist combine to give useful principles in the utilization of inputs in achieving a maximum efficiency in output production.

As soon as the manager is past the stage of the one-man firm, his success must depend more and more on the work of his subordinates. This emphasizes the importance of successfully combining the efforts of employees in the performance of essential activities of the firm. Here the manager performs the function of organizing, in which activities are grouped and assigned to persons responsible for their execution. Organization engineers rate the function of organization one of the most difficult tasks of the

chief executive. What principles underlie the establishment and maintenance of an efficiently functioning organization? Can we afford to avoid a discussion of this area in our course, or to pass over it lightly?

Another function of the executive is direction. This is concerned with the way the manager issues instructions to his subordinates, how he indicates what it is that should be done. Here again, as William H. Newman points out, is a function which is poorly performed by many managers, who give it insufficient attention (2). If the manager neglects the important task of training his personnel, normal or standard performance cannot be obtained with the proper economy of time and materials. Those of us in the teaching profession realize that telling is not teaching, yet unless the techniques of teaching—training others—are adequately presented to the manager trainee, he will be left with a serious gap in the background required of the professional manager. We have tended to act as though it were enough to emphasize the importance of training others, instead of giving our students the experience of using in the classroom those techniques which industry has proved to be essential in the procedure for teaching the job. For example, demonstration and explanation are invaluable parts of the training method, but often these are not enough for many training situations. What must be added?

Another major problem in direction is that of motivating the employee. The problem of human motivation, of human relations, has been considered so important by industry that a large body of literature has grown up to discuss and explain the ways in which the human factor affects productive efficiency. Educational institutions and professional management groups conduct a continuing series of seminars where top and middle management are trained to recognize the importance of the human factor in production, and to deal with it more intelligently. Here we need something quite different from an abbreviated version of the Dale Carnegie success course, or a neat list of twenty-seven rules of thumb on how to pat the worker on the back, to ease his hunger for approval, and to let him know when a change is in store for him. I am suggesting here that we owe the student at least an introduction to the basic concepts in social and industrial psychology.

Direction is not adequately accomplished without adequate communications. "The ability to respond to and with symbols may be the single most important attribute of a great administrator," according to Wendell Johnson (3). "Mr. A. talking to Mr. B. is a deceptively simple affair, and we take it for granted to a fantastic and tragic degree." It is my conviction that the student should be given at least a speaking acquaintance with the literature in this field. I particularly recommend the series on communications for executives published by the *Harvard Business Review*.

The manager trainee must also understand the nature of control, the function by which policies and goals are made more effective by procedures which work towards assuring that performance is according to plan. How are standards set? How are they related to individual responsibility? What is the function of strategic control points? When and how is the executive to check on performance? These are questions which the professional manager must answer for himself—and which our teaching should direct to the attention of manager trainees.

Finally, let me suggest that we investigate the foundations of a management philosophy. A successful manager must acquire more than a knowledge of facts, methods, and administrative techniques; he must also acquire certain habits and attitudes. As Mary Parker Follett has indicated, the "first essential of business success is the capacity for organized thinking." (4) So I am suggesting here that we give our attention also to an investigation of management philosophy. Although this may be slow going for the trained instructor, and even more difficult for the student unskilled in handling abstract concepts, there is much in such sources as *Dynamic Administration* which is essential to an understanding of the entire process of administration. (5)

From this discussion it may appear to you that I am suggesting more subject matter here than can be contained in one or even two semesters of pharmacy management. But let me put it this way: Suppose a liberal arts graduate with a major in chemistry were to be prepared to function also as a professional pharmacist. Would you suggest that one course would be enough? Two? Three? Not only have we agreed that the practical pharmacist cannot become a professional pharmacist even after ten years of trial and error learning, but we also have emphasized that two or three courses cannot make a competent chemist into a graduating, professional pharmacist. Training for professional business management usually requires the major portion of the business administration student's time for approximately three years. Even though we select most carefully from the basic areas in the management field, can we still expect to give our management trainees a good introductory management course in three or even six hours? This, of course, is another problem, but an investigation of the necessary content for a basic management course has been the objective of this discussion.

Ralph C. Davis makes the distinction between the business mechanic and the professional executive (6). The former may be defined as the man who has learned his trade principally in the school of hard knocks, and by the process of trial and error. The professional executive, on the other hand, has a broad, fundamental basis for effective thinking in the solution of managerial problems. He has developed a sound philosophy of management and has a basic understanding of the essential techniques of administration. The business mechanic may still operate with reasonable effectiveness as long as his problems do not become too complex, and his firm remains relatively small. But he is the kind of manager who is more likely to be vulnerable to competition, and less likely to meet successfully the challenge of major change.

"The stereotype of the successful business man is indeed changing," as Mary Parker Follette points out. "The image of the masterful man carrying all before him by the sheer force of his personality has largely disappeared." (7) The business mechanic, the persuader, the improviser, not only fails to meet the challenge of the business world—he also fails to measure up as a professional man. It seems to me we need pharmacy managers who are professional men, both as managers and as professional pharmacists. This is truly a big order. What are we doing about it?

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It is unnecessary to develop the thesis that too many colleges unfortunately are more interested in their enrollment than in the qualifications of their students.

Rudolph A. Kuever, Am. J. Pharm. Ed., 7, 48 (1943)

REPORT OF THE DELEGATE TO AMERICAN PHARMACEUTICAL ASSOCIATION HOUSE OF DELEGATES INTERIM MEETING 1958

The interim meeting of the House of Delegates was held in Chicago on October 30-31, 1958.

The program included the following addresses and reports:

1. Address of Chairman J. Warren Lansdowne, which reviewed the objectives of the A.Ph.A. and interpreted them in contemporary terms.
2. Report of Secretary Fischelis, reviewing the action taken on the resolutions of the Los Angeles meeting, and the current status of the Building Fund.
3. Report by George Griffenhagen on a survey of A.Ph.A. resolutions of the past thirty years.
4. Report of the Committee on Legislation, by Chairman F. Royce Franzoni, which included a review of the Special Conference on Problems of Drug Distribution held the day previous to the meeting of the House of Delegates.
5. Report of the Committee on Social and Economic Relations, by Chairman Stephen Wilson.

In addition to the above, two representatives from the American Medical Association, C. Joseph Stettler, Director, Legal Department, and Leo Brown, Director of Public Relations, spoke to the House.

In his review of A.Ph.A. objectives Chairman Lansdowne made the following observation in reference to the objective dealing with education and training in the art of pharmacy: "In terms of contemporary action this (objective) means that the A.Ph.A., representing all branches of pharmacy, must continue . . . to foster greater participation on the part of practitioners of pharmacy in developing our formal education of pharmacists to meet the training requirements which pharmacy's changing and new responsibilities demand. As a profession we must become much more vocal in the Conference with those who do the teaching with respect to how the valuable times of students of pharmacy is to be spent during their formative years. A Conference of practitioners of pharmacy on the educational needs of future practitioners is long overdue."

As a result of this statement the Resolution Committee proposed "That a conference of practitioners be called to consider the educational needs of those who will enter the profession of pharmacy in the future and to determine how best to provide the training which will be needed to produce competent personnel for all phases of the practice of pharmacy." This recommendation was approved by the House and referred to the Council for implementation.

The report of the Committee on Social and Economic Relations did not dwell on the manpower situation as did the two previous reports. Instead, it emphasized the need for immediate consideration of prepayment plans

for drugs; such consideration to encompass not only the possibility of including prescription costs within the scope of existing medical care plans but also the possibility of plans concerning only prescription costs.

Pursuant to this report, the House of Delegates authorized the Committee on Social and Economic Relations to contact appropriate groups to obtain information on prepaid insurance programs for prescriptions. The urgency of this major subject was apparent by the extensive and deliberate consideration of the members of the House.

A resolution, originating with the Executive Committee of the American Society of Hospital Pharmacists, took cognizance of the establishment of short courses for training pharmacy technicians. The House referred this to the Council. The Council in subsequent action has instructed the Secretary to investigate the problem.

This situation was brought to the attention of the Executive Committee of the AACP at its November meeting and is under investigation in cooperation with the A.Ph.A.

Charles W. Bliven, Delegate

They have achieved the power to formulate ideals, but not as yet the full inner power to practice them.

Curtis Bok, Am. J. Pharm. Ed., 7, 289 (1943)

PRESIDENT'S SECTION . . . . . .

TAKE CARE

The discussions surrounding each major change in pharmaceutical education had a similarity to those now being presented in connection with the five year program. Each time some feared that we were educating ourselves out of the marketplace. Others were apprehensive lest the superior trained individual rebel at performing the functions for which he was specifically educated. Today there are a few individuals who would wish that we might return to the two year academic program, and there are others who would consider return to the three year course. The majority, however, agree that the most vital step in the elevation of pharmacy occurred at the time of the transition from the three to the four year baccalaureate program. This, for the first time, placed the graduates of the colleges of pharmacy on a firm education foundation. The four year program was the step which secured our position in the academic world. Truly, this was the first time that holders of a degree in pharmacy had a reasonable opportunity for acceptance as candidates in the graduate schools of our country.

This year, 1959, terminates pharmacy's four year academic program. In 1960 all colleges of pharmacy will be operating on a five year minimum total program. Pharmaceutical educators are well informed regarding the three basic types of pharmaceutical curricula. We know that there was no attempt to "strait-jacket" the academic and professional training of the pharmacist beyond adopting fundamental principles of good pedagogy and improving the sequential arrangement of the professional courses. It is to be expected and desired that there will be some variance in the basic professional curricula, and it is hoped that these curricula will always be constructed with the benefit of the student in mind. It is important that our professional program be so designed as to be acceptable by a majority of the graduate colleges. The level at which our courses are taught, and the syllabi of the courses must be meticulously planned to disassociate them from any resemblance to a technical training program. In other words, our professional program must be based upon the fundamentals of the physical, chemical, and biological sciences. This requires care, coordination, and cooperation on the part of each faculty.

In the development of the five year program we are, for the first time, afforded "adjusting space" for an overcrowded professional curriculum. Opportunity is being provided for the student to select a reasonable number of electives. The choice of electives should, of course, be as broad as is consistent within a heavy professional program and as flexible as possible to offer the greatest option to the student. Care, however, must be exercised that our five year undergraduate program is not used to dilute certain well-designed graduate programs in pharmaceutical education. The requirements for a baccalaureate degree in pharmacy should be just that. Graduate

credit must only be allowed for work at the advanced level and at a time when the student has satisfied all of the core requirements for his undergraduate degree. To do otherwise will jeopardize the position of pharmacy at both the educational and the industrial levels.

It has been a long and difficult task to convince some of the graduate faculties on our college campuses that pharmaceutical education is a discipline in which there is a specific and definitive program for students at the master's and doctoral levels. It was not easy to "sell" our early Ph.D. candidates to pharmaceutical industry. This, no doubt, resulted through the confusion of the doctor of philosophy program with the very early qualifications for a professional doctoral degree. Suffice it to say there was reason for this doubt, and cause for this concern. Fortunately, students with advanced degrees from the colleges of pharmacy today are competitive with candidates from all of the other graduate disciplines. We must not dilute our graduate programs. It has been too difficult to get the "nod" of industry, and anything which dilutes the quality of our training at the advanced-degree level will also be reflected in our undergraduates.

The five year program will present an excellent foundation for the construction of a graduate training curriculum. Now we will have individuals who will be better trained, both at the general and the professional levels. Care must be exercised by those colleges of pharmacy currently offering graduate training to be certain that their courses meet the highest standards of other graduate programs. Hybridized or diluted courses at the graduate level are not acceptable and must not be condoned. Those of us operating graduate divisions at this time must take a critical look at all of the offerings being made for advanced degrees.

Those colleges of pharmacy contemplating the development of graduate instruction should seek the counsel and advice of others who have had experience in the field of advanced professional educational training. Care should be exercised by all colleges of pharmacy when attempting to initiate a graduate program. There are many problems associated with the implementation of graduate instruction, such as staff, space, equipment, and operating funds. Assistance can be sought from the Director of Education of the American Council on Pharmaceutical Education, and problems of administration can be shared with the deans and faculties of those schools which have had many years of graduate teaching experience.

Pharmacy has endeavored, through the adoption of the five year program, to design the undergraduate plan of study on a solid foundation in social, psychological, and professional education. I believe that this program should fortify our graduate curricula and, if we work together, will result in elevating the total position of our profession as never before realized in the other transitional periods. We will not err too far if we remember that the products of graduate training are the people who will be our leaders in pharmaceutical industry and in pharmaceutical education. Teachers determine the quality of education. The acceptance of our teachers in the field academic and the acceptance of our Ph.D., master's, and baccalaureate people in commerce and industry will reflect the total pharmaceutical picture. Therefore, it behooves us to use extreme care in designing our graduate program.

Louis C. Zopf

EDITORIAL . . . . . .

I recently read an article in which a faculty member classified his institution as one comprised of mediocre students and a mediocre faculty. Unless there is a valid rating scale which places faculty and students in categories of *good, mediocre* and *poor,* one can assume only that this gentleman's judgment was a personal one based upon many years of experience in many various-type institutions. Had he had many jobs? Was he less than mediocre himself and hence unable to make quality judgments of faculty and students? I think the criticism of students was the most telling. In the words of Sidney Hook in *Education of Modern Man,* ". . . no one worthy of being a teacher will fail to see the interesting variety of potentiality in every group."

Whenever one attempts to list the qualifications of a good teacher, one always must list the teacher's attitude, his excitement for learning, his feelings, and his outlook on life which are quite apart from what he knows or how well he knows it. *What* and *how well* are of primary importance and are goals which can be reached, like most, only through process. Education is primarily a *process* of reaching those goals—a process in communication.

Maria Callas and Eartha Kitt have one thing in common as musicians—they communicate well to those who enjoy hearing them. Madame Callas knows few peers as an artist and as a musician; Eartha Kitt can't read music. But each through her own showmanship has reached a goal, the goal of communication. With us the principal goal is knowledge and the process is communication. For some the process of communication in teaching is difficult; for some, impossible. For the latter we should wish God speed to the industry, for in our colleges and universities these misfits only promote intellectual retardation.

In the yeast of every student body there is a ferment of idealism and emotional virility waiting for the proper climate to burst forth into the stuff of which good education is made. In every good teacher there must be a vigor, vitality, and an exuberance permeating everything he does in the classroom. The result will be people learning—not just being taught. The pace may be fast and the road strewn with those who couldn't stand the pace—but no matter—they'll plod the more for having been on the highway. And when it's all over and the goal is in sight, there will be those who hurt and sting and lick their wounds from the challenge and the effort, but the goal will have been reached; knowledge will have been gained; wisdom will be served.

There must be a motivation from within to learn, and it must be planted or nurtured as the case may be. If it can be done on an individual basis, fine, but if larger classes prevent this, there is no reason for dismay; rapport with students need have nothing to do with numbers. It isn't necessary to coddle students; most need only guidance and opportunity; and some, a motivating force. The force may be you. Mark Hopkins described the ideal numerical ratio of student to teacher as one to one on either end of a log. There are some teachers I know who couldn't communicate a log's length! The goal of successful teaching is something which must be pursued with the energy of a man looking for gold. There must be an uninhibited flow of constructive forces of the teacher's own personality which help his students express theirs. To be completely successful

the teacher must have a rapport with students and be genuinely attached to them as partners in the process of learning; and they must feel that they are an integral part of the process. Both must emerge with the feeling that something has happened—this is the flavor and substance of good teaching.

And for those students who need the encouragement in any teaching situation, there must be encouragement. A teacher who looks for failure in a student is seldom disappointed; a teacher who looks for and promotes the best in students is likewise seldom disappointed. There are those students who can transcend themselves; the latent powers of ability are not only manifest in situations of physical stress. With the right interest and instruction, a student can surprise himself as any teacher worthy of the name well knows.

And so to the man who says he teaches a mediocre student body, I say, "get thee to the hills and look upon thyself."

Melvin R. Gibson

ANNOUNCEMENTS . . . . . .

Librarian course. A course in pharmaceutical literature and librarianship will be offered during the summer of 1959 by the School of Library Service, Columbia University. The course listing is as follows:

Description: Library Service s220P. Pharmaceutical Literature and Librarianship. 3 points. Summer. Miss Sewell. Daily, 7-8:40 p.m., July 6-24. 511 Butler.
A survey and evaluation of library resources in the field of pharmacy with emphasis upon bibliographical and information sources. Attention will be given to special service problems and organization in pharmaceutical libraries.

This offering stems from a project of the Joint Committee on Pharmacy College Libraries of the AACP. Miss Winifred Sewell, Librarian, Squibb Institute for Medical Research, is the instructor.

Journal addresses. With this issue this journal has changed its method of addressing to an IBM punchcard process. If your journal is incorrectly or incompletely addressed and thus delayed in reaching you, please notify the Editor immediately.

Seminar program. The annual teachers' seminar sponsored by the AACP and supported by the AFPE will be held in Chicago, August 9-13. This year's program in pharmacognosy is as follows:

SUNDAY, AUGUST 9, 1959

9 A.M.-2 P.M. Registration, Lobby, Pharmacy Building
Opening Session, Room 55A
G. L. Webster, Presiding
"Opening Remarks," G. L. Webster
"Welcome," H. E. Longenecker
"Greetings from the American Foundation of Pharm. Educ.," W. Paul Briggs
"Implementation of Seminar Suggestions," Louis C. Zopf
"Observation on Current Teaching in Pharmacognosy," Melvin W. Green
"The New Pharmacognosy — What it is and Where it is Going," Melvin R. Gibson

6:30 Dinner and Reception for Seminarians and their Families, Student Residence Hall

MONDAY, AUGUST 10, 1959
Room 55A, Pharmacy Building
Harold G. Hewitt, Presiding

8-9 A.M. Registration, Pharmacy Building Lobby
8:45 Opening Remarks
9:00- 9:30 "Prerequisites for the New Pharmacognosy," Willis R. Brewer
9:30- 9:45 Discussion
9:45-10:15 "Essential Topics in Undergraduate Pharmacognosy," Edward P. Claus
10:15-10:30 Discussion

10:30-10:40	Coffee Break
10:40-11:10	"An Individual Approach to the Presentation of the Essential Topics. I. Based on the Taxonomic System," Maynard W. Quimby
11:10-11:40	"II. Based on Cellular Contents and Activity," Jack Beal
11:40-12:15	Discussion
12:30- 1:30	Lunch
	Varro E. Tyler, Jr., Presiding
1:30- 2:00	"Laboratory Presentation of the Essential Topics," Stephen K. Sim
2:00- 2:15	Discussion
2:15	"Audio-visual Aids in Teaching Pharmacognosy." Demonstration Laboratory Exercises on Pertinent Topics in Pharmacognosy (These demonstrations will be set up in Laboratories 304 and 346 allowing time for Seminarians to move freely from one table to another.)
4:30- 5:00	"Summary of Audio-visual Methods," Ralph F. Voigt

TUESDAY, AUGUST 11, 1959

Ralph F. Voigt, Presiding

9:00- 9:30	"Advances in the Biological Sciences of Interest to Pharmacognosy," Frank A. Crane
9:30- 9:45	Discussion
9:45-10:15	"Phylogeny and Chemical Constituents," Varro E. Tyler, Jr.
10:15-10:30	Discussion
10:30-10:40	Coffee Break
10:40-11:10	"Biosynthesis of Nitrogenous Drugs," Arthur E. Schwarting
11:10-11:25	Discussion
11:25-11:55	"Biosynthesis of Non-Nitrogenous," H. W. Youngken, Jr.
11:55-12:10	Discussion
12:30- 1:30	Lunch
	Frank A. Crane, Presiding
1:30- 2:00	"Advances in Natural Product Chemistry," Lloyd M. Parks
2:00- 2:15	Discussion
2:15- 2:45	"The Literature on Pharmacognosy," James E. Dusenberry
2:45- 3:00	Discussion
3:00- 3:10	Coffee Break
3:10- 3:40	"Cultural Uses of Pharmacognosy," Richard A. Deno
3:40- 3:55	Discussion
3:55- 4:25	"An Educational Psychologist Looks at Teaching in Pharmacognosy," N. L. Gage
4:25- 5:00	Discussion

WEDNESDAY, AUGUST 12, 1959

RECENT ADVANCES IN TECHNOLOGY

Louis C. Zopf, Presiding

9:00- 9:30	"Economics of Drug Plant Production," Ralph F. Voigt
9:30- 9:45	Discussion
9:45-10:15	"Commerce in Natural Drugs," Edson F. Woodward

10:15-10:30	Discussion
10:30-10:40	Coffee Break
10:40-11:10	"Recent Advances in the Anatomy and Histology of Drug Plants," H. W. Youngken, Sr.
11:10-11:25	Discussion
11:25-11:55	"Recent Advances in Plant Microchemistry," Gunnar Gjerstad
11:55-12:10	Discussion
12:30- 1:30	Lunch
1:30- 4:00	Field Trip to University of Illinois Drug and Horticultural Experiment Station and The Morton Arboretum
4:15- 4:45	Introduction of Staff at The Morton Arboretum by R. F. Voigt
4:45- 5:00	"Recent Developments in Greenhouse Management," Neal M. Fosler
5:00- 5:15	Discussion
6:00	Dinner Downers Grove, Illinois
7:30 P.M.	"Exploring for New Drug Plants" Thornhill Building Auditorium, Morton Arboretum

THURSDAY, AUGUST 13, 1959

GRADUATE EDUCATION IN PHARMACOGNOSY

H. W. Youngken, Jr., Presiding

9:00- 9:30	"The Application of Fermentation Technology to Pharmacognosy," H. W. Youngken, Jr.
9:30- 9:45	Discussion
9:45-10:15	"Chromatography and Electrophoresis in Pharmacognosy," Tracey G. Call
10:15-10:30	Discussion
10:30-10:40	Coffee Break
10:40-11:10	"Advances in Quantitative Microscopy," Marin S. Dunn
11:10-11:25	Discussion
11:25-11:55	"Application of Microscopy to Crime Detection," Paul D. Carpenter
11:55-12:10	Discussion
12:30- 1:30	Lunch
	Arthur E. Schwarting, Presiding
1:30- 2:00	"Obtaining Funds for Research in Pharmacognosy," Edward P. Offutt
2:00- 2:15	Discussion
2:15- 2:45	"Radioactive Isotopes in Pharmacognosy," Ara G. Paul
2:45- 3:00	Discussion
3:00- 3:10	Coffee Break
3:10- 3:55	"Application of Instrumentation to Pharmacognosy," Egil Ramstad and Edelbert Knevel
3:55- 4:15	Discussion

LETTERS

Editor's Note. The following letter was received from Senator Warren G. Magnuson in response to a detailed letter containing much of the information in the editorial of the Winter, 1959 issue and a file of information provided by the Health News Institute.

UNITED STATES SENATE
Committee on
Interstate and Foreign Commerce

12 February 1959

Dear Dr. Gibson:

I appreciate very much the thoughtful comments contained in your February 3rd letter regarding the cost and preparation of pharmaceutical products. I am having a member of the Appropriations Committee staff, who has been working with me over the years, go through the material and give me his ideas on what, if anything, we might do to correct any false impressions that have been created.

I am impressed by the facts and figures you cite, both as to the research investment pharmaceutical companies are making and the relationship of prescriptions to the cost of medical care.

Thanks for taking the time to write to me. Best personal regards.

Sincerely,
(signed)
Warren G. Magnuson
U.S.S.

WGM:Hf

March 31, 1959

Dear Dr. Gibson:

I am writing this letter with the hope that its publication in the *Journal* will draw the attention of my colleagues in pharmaceutical education to a serious problem. I refer to the practice at some institutions of allowing some of our foreign students to "get by" with poorer academic performances than are expected of our own students. Usually such a practice is justified upon the basis that it would be better for some foreign countries to have poorly qualified scientists and educators than to have none at all. Criticism of this attitude is frowned upon as an example of lack of international spirit and understanding. Fortunately, having once been a foreign student, I am under no "social" pressure to subscribe to this misguided humanitarianism.

It seems to me that any faculty member, department, or school that condones such an attitude is doing disservice to (a) the student, (b) the student's country, and (c) the United States.

(a) Nowadays even in the most underdeveloped countries it is rare for a returning foreign student to avoid a situation in which he will be judged by and be in competition with his professional peers. These countries are rap-

idly accumulating a number of persons educated in the United States, Great Britain, Germany, Japan, Australia, etc. The students upon whom we confer degrees and send back will be competing with these persons for jobs and later for promotions and advancements. Hence, to graduate a poorly qualified foreign student is to condemn him to a frustrating professional experience.

(b) To say that it might be better for any country (particularly an underdeveloped one) to have poorly qualified persons, rather than to have none, is to overlook certain obvious facts. First, the American universities are not training foreign students to be technicians; rather we hope they are being educated to be scientists who will return and train their own technicians. Whereas one might say that a poor technician may at times be better than none, one cannot say the same thing about scientists who will be expected to train personnel and plan, organize, and administer new and, at times very extensive developments. (Developments upon which the future of these countries might depend.)

Second, in many instances it is difficult to imagine where a poorly qualified person is of any value; for example, more harm could be done by a pharmacist who developed defective and unstable products than might be caused by the lack of such products.

(c) In reading journals from certain Asian countries, I have become aware of the terrific competition that is being offered by Russian aid and Russian experts to our attempts to win over ideologically countries in that part of the world. Very often students returning to these countries with degrees from the United States have to work with Russian experts or counterparts. The performance of these students cannot help but *greatly* affect our reputation (and therefore our efforts). I cannot emphasize enough the *tremendous* importance of this type of gain or loss in our reputation. This is particularly true in the underdeveloped countries whose future depends so much on the opinions held by a handful of its intellectuals. Unfortunately, this is the point that seems to least interest faculty members. Possibly this is so because all this is not (yet?) close enough to home.

Sincerely,
(signed)
V. N. Bhatia
Associate Professor of Pharmacy
State College of Washington

Pharmacy is a personal, not a corporate service.
Hugh C. Muldoon, Am. J. Pharm. Ed., 6, 186 (1942)

MEMORIALS

EDWARD H. NILES

Dr. Edward H. Niles, Dean Emeritus of the Butler University College of Pharmacy, died September 23, 1958, at the age of seventy-six. He was born at Orinsky, New York, but had lived in Indianapolis, Indiana, since 1911. He was dean of the Indianapolis College of Pharmacy from 1921 to 1945. In 1945, the college affiliated with Butler University and became the Butler University College of Pharmacy. Dr. Niles continued to serve as dean until his retirement in 1952.

At the dedication services of the new building for the Butler University College of Pharmacy in May, 1952, the pharmacy library was dedicated as the Edward H. Niles Library in recognition of his long service in the field of pharmacy and his work as a teacher. A bronze plaque bearing his name was placed permanently on the door of the library. This memorial library, which is a branch of the university library, contains 7,200 volumes dealing with the science of pharmacy and its allied subjects, many of them collected during the years in which Dr. Niles was dean of the college.

Dr. Niles held the academic degrees of Ph.C. and Pharm.D. from the Indianapolis College of Pharmacy and the A.B. degree from Butler University. He also had attended Indiana University and the University of Chicago. He served as instructor and professor of pharmacy at the Indianapolis College of Pharmacy prior to becoming dean of the college. He was a registered pharmacist in Indiana and a member of the American Pharmaceutical Association. He served a year as chairman of the Indiana section of the American Chemical Society and was a former member of the Indiana Interprofessional Health Council. His other memberships included the Indiana Academy of Science, Phi Kappa Phi and Kappa Psi Fraternities, Mystic Tie Masonic Lodge, Murat Shrine, Knights Templar, Keystone Chapter of Royal Arch Masons, Indianapolis Council of the Masonic Lodge, and Eastern Star. He was a member of the Episcopal Church.

Under the able leadership of Dr. Niles, what is now the Butler University College of Pharmacy grew from a small beginning to become one of the leading colleges of pharmacy in the country. He was a man with many talents, one of them being an inspirational teacher of exceptional ability. He maintained individual contact with each of his many students in the College of Pharmacy, and always found time to assist young people in solving many of their personal, as well as academic, problems. From these personal contacts many lasting friendships were developed, and many deeply appreciative former students remember his helpfulness to them. Those who had the privilege of working with Dr. Niles feel the loss of a true friend and a wise counselor. He has left behind the record of a work well done.

Dr. Niles is survived by his widow, Mrs. Pearl H. Niles, and two grandchildren.

N. L. Michener, A. A. Harwood, and E. J. Rowe

C. LEONARD O'CONNELL

C. Leonard O'Connell was born in Allegheny, Pennsylvania, on April 24, 1890. He was the son of the late John H. and Charlotte Mullen O'Connell. Dr. O'Connell began his career in retail pharmacy, having spent his time from 1906 to 1922, before entering the educational field, in various phases of retail work, including actual drugstore selling, as well as on the sales force of a wholesale firm and as a merchandise broker and manufacturer's agent.

In 1922 he was invited to return to his Alma Mater, from which he had received his Ph.G. degree in 1912, as a member of the chemistry faculty of the School of Pharmacy. He was made professor of pharmacy and director of courses in pharmaceutical economics in 1926 and became associate dean of the school in 1930. In 1932, when Dr. Koch retired Dr. O'Connell was elected dean.

He was very active in state and national pharmaceutical and alumni work, being the first president of the Pharmacy Unit of the Alumni Association (1931). He also served as chairman of various committees in state and national associations, and as president of the Pennsylvania Pharmaceutical Association (1929-1931). As a member of the Revision Committee for the United States Pharmacopeia from 1940-1950, and as a member of the International Federation, he has had active association with his chosen field. He was particularly interested in Kappa Psi and was elected to the position of Grand Regent of this pharmaceutical fraternity in December 1941. His activities outside the pharmaceutical field included a term as president of the Civic Club of Allegheny County and chairman of the Board of Managers of the Juvenile Detention Home.

Dr. O'Connell received his A.B. in 1916 and his Pharm.D. in 1932. He also holds an honorary Pharm.M., from Philadelphia College of Pharmacy and Science.

Due to ill health, he was made dean emeritus on May 31, 1945. His books *Manual on Pharmaceutical Law* and *Manual on Pharmaceutical Technique*, however, are still used as reference texts in pharmacy schools throughout the country.

In 1920, Dr. O'Connell married Florence Parlyne Sheridan. They have four sons, C. Leonard O'Connell, Jr., John F. Regis, William S., and Richard. Three of them have embarked on careers in the health professions: C. Leonard O'Connell, Jr., practices medicine in a nearby community, while his brothers Regis and Richard are registered pharmacists in Pittsburgh.

Though he had been retired from active life for some time, his dynamic personality and inspired teaching are still remembered by many of the pharmacists of the Tri-State area.

To those of us in education who were privileged to know him, his contributions to pharmaceutical associations, the profession of pharmacy and pharmaceutical education as well as community service are well recognized.

Dr. and Mrs. O'Connell both died during 1958.

Joseph A. Bianculli

NEW LITTLE PEOPLE

Mary Frances Hardigan—born February 26, 1959, to Mr. and Mrs. William D. Hardigan, University of Wyoming.

John Michael Wintter—born March 3, 1959, to Dr. and Mrs. John E. Wintter, Howard College.

Collette Stephanie Venturella—born January 15, 1959, to Mr. and Mrs. Vincent Venturella, University of Pittsburgh.

Tamra Mae Billups—born December 19, 1958, to Mr. and Mrs. Norman Billups, Oregon State College.

Timothy David McClure—born February 6, 1959, to Mr. and Mrs. David McClure, Oregon State College.

Leslie Ellen Young—born March 13, 1959, to Dr. and Mrs. John C. Young, Philadelphia College of Pharmacy and Science.

Kevin Robert Parke—born February 7, 1959, to Dr. and Mrs. Russell Parke, Butler University.

Carol Jean Rost—born January 12, 1959, to Dr. and Mrs. William J. Rost, University of Kansas City.

David Warren Tuttle—born October 30, 1958, to Mr. and Mrs. Warren Tuttle, University of Kansas City.

Gail Susan Doorenbos—born February 19, 1959, to Dr. and Mrs. Norman J. Doorenbos, University of Maryland.

Matthew Gregory Zanowiak—born February 4, 1959, to Dr. and Mrs. Paul Zanowiak, University of Florida.

STAFF CHANGES

NEW STAFF MEMBERS

Rutgers, the State University of New Jersey. Mr. Augustus De Maggio has been appointed assistant professor of pharmacognosy effective this summer. Mr. De Maggio obtained his master's degree from Massachusetts College of Pharmacy and will receive his doctorate degree in June from Harvard University where he is completing his work in the Biological Laboratories.

Ferris Institute. Dr. Harry S. Swartz, Jr., has been appointed assistant professor of pharmacy and pharmacy administration. Dr. Swartz received his Ph.D. from the University of Iowa.

University of Florida. Dr. Lemont B. Kier has been appointed assistant professor of pharmaceutical chemistry. Dr. Kier received his Ph.D. from the University of Minnesota. Mr. Richard J. Hampton has been appointed interim associate professor of pharmacy effective the next academic year. Mr. Hampton will complete his Ph.D. degree requirements at the University of Wisconsin this summer; he is now an assistant professor of pharmacy at the State College of Washington.

University of Tennessee. Dr. Martin E. Hamner has been appointed to the staff effective July, 1959. Dr. Hamner was formerly on the staff of Southwestern State College.

Southwestern State College. Mr. C. Dwayne Ogzewalla has been appointed to the staff of Southwestern State College effective in September. Mr. Ogzewalla taught at the University of Colorado for four years and will complete work toward his Ph.D. degree this summer at the University of Utah.

CHANGES IN STAFF TITLES

University of California. Dr. Eino Nelson has been promoted from assistant professor of pharmacy to associate professor.

Florida Agricultural and Mechanical University. Mrs. Geraldine D. Roberts has been appointed curator and instructor of hospital pharmacy.

MARRIAGES . . . . . .

Dr. Leslie Costello, Assistant Professor of Zoology, University of Maryland, to Miss Anna Louise Hill, January 24, 1959.

Dr. Thaddeus S. Grosicki, Associate Professor of Pharmacy, University of Arkansas, to Dr. Jeanette F. Plutnicki, December 27, 1958.

It is (the pharmacists') ***duty, therefore,*** *ever to become more efficient and more kindly "bringers of help" to all mankind.*

Hugh C. Muldoon, Am. J. Pharm. Ed., 6, 190 (1942)

GENERAL NEWS

Pharmacy Administration Seminar. Dr. Louis M. Orr, President-elect of the American Medical Association, will be among the prominent lecturers and guest speakers at the Pharmacy Education-Industry Forum, Carl K. Raiser, President of the National Pharmaceutical Council, has announced The Forum will be held August 23-26 at the Princeton Inn, Princeton, New Jersey.

In addition to Dr. Orr, Mr. Raiser announced that George P. Larrick, Commissioner of the Food and Drug Administration; Harry J. Anslinger, Commissioner of the Bureau of Narcotics; Clarence Faust, Vice President of the Ford Foundation; and Dr. W. Paul Briggs, Secretary and Executive Director of the American Foundation for Pharmaceutical Education, will address the educators on the roles that their respective agencies play in the betterment of the public health. Dr. Theodore G. Klumpp, President of the Winthrop Laboratories, will deliver the keynote address on Sunday evening.

These guest speakers will supplement a Forum lecture-workshop program conducted by executives from leading pharmaceutical firms. During each morning of the Forum, four executives will deliver lectures dealing with various facets of the pharmaceutical industry. In the afternoon, these lecturers will discuss industry philosophies in question and answer workshop sessions.

Among the many industry leaders who will appear on the Forum program as lecturers and moderators are: William L. Arscott, Vice President of E. R. Squibb & Sons; Thomas Brown, General Sales Manager of Roche Laboratories; Robert B. Clark, Senior Vice President of Warner-Chilcott Laboratories; Fred A. Coe, Jr., Vice President of Burroughs Wellcome & Co. (USA) Inc.; Nelson M. Campfer, Chairman of the Board of the Wm. S. Merrell Co.; Paul Gerden, Secretary and General Counsel of Abbott Laboratories; Ernest Hammer, President of Geigy Pharmaceuticals; J. Arthur Hill, Vice President of Sales of Mead Johnson & Co.; Henry S. McNeil, President of McNeil Laboratories, Inc.; Harry W. McNey, Director of Sales of Lederle Laboratories; Franklin P. O'Brien, Vice President of G. D. Searle & Co.; George W. Orr, Jr., President of Ames Company, Inc.; Alfred C. Scott, Manager of Hospital Sales of The Upjohn Company; L. J. Sichel, Vice President and Counsel of CIBA Pharmaceutical Products, Inc.; Kenneth F. Valentine, President of Pitman-Moore Co.; and Foster B. Whitlock, President of Ortho Pharmaceutical Corporation; Edward J. Carroll, Director of Economic Research of Merck Sharp & Dohme; Robert H. Hosick, General Law Department Head, The Upjohn Company; Richard L. Hull, Director of Marketing of Smith Kline & French Laboratories; Raymond D. McMurray, General Counsel of Hoffmann-LaRoche, Inc.; Lloyd C. Miller, Director of Revision of the United States Pharmacopoeia; George S. Squibb, Assistant Director of Sales of E. R. Squibb & Sons; and Tobias Wagner, Advertising Manager of Smith Kline & French Laboratories.

According to Mr. Raiser, "Plans for the Forum are progressing rapidly and we are extremely pleased by the caliber of speakers and lecturers who have already accepted our invitation."

The Forum, sponsored by the National Pharmaceutical Council in cooperation with the American Association of Colleges of Pharmacy, is being conducted for faculty representatives from each of the nation's seventy-six colleges of pharmacy.

Raiser said information concerning the philosophy and workings of the pharmaceutical industry will be explained to the pharmacy educators, in the hope that this information will be transmitted to pharmacy students throughout the nation.

Closed circuit TV. An experiment in medical education—for the first time linking five major medical schools by closed circuit TV—took place in Philadelphia starting March 31.

Joining in this first network for undergraduate medical education are the University of Pennsylvania School of Medicine, Jefferson Medical College, Temple University School of Medicine, Hahnemann Medical College, and Woman's Medical College of Pennsylvania. The programs were produced by the Medical Education Service Unit of Smith Kline & French Laboratories. The special telecasts, a series of five lectures by Dr. Joseph W. Spelman, Medical Examiner for the City of Philadelphia, mark the first time that five medical schools have used the technique of television for joint lecture-demonstration purposes. By means of an electronic hook-up, the lectures were televised to the five schools from a "studio-laboratory" in an SKF building.

A total of some 1,300 students in selected classes of the schools watched the color telecasts on screens as large as 4½-by-6 feet in their own auditoriums. In addition, an expected 400 guests also viewed the sessions. The series of 45-minute programs were scheduled for 5:15 p.m. on March 31, April 2, 6, 8, and 10. Subject of the lectures was "Forensic Medicine."

Special equipment was installed at each of the colleges to receive the programs. A telephone hook-up was used to relay the students' questions directly to Dr. Spelman through a moderator at each of the schools.

The idea for the lecture series grew out of talks between Dr. Charles S. Cameron, Dean of Hahnemann Medical College, and officials at Smith Kline & French.

AFPE meeting. John J. Toohy, General Manager, E. R. Squibb & Sons, Division of Olin Mathieson Chemical Corporation, was elected President of the American Foundation for Pharmaceutical Education at the 17th Annual Meeting of the Foundation held March 5, 1959, at the University Club, New York, New York. John G. Bill, President, Merck Sharp & Dohme, Division of Merck & Co., Inc., was elected Vice President. Carl K. Raiser, Director of Distribution, Smith, Kline & French Laboratories, was elected Treasurer; James F. Hoge, Rogers, Hoge & Hills, was re-elected Counsel, and W. Paul Briggs was re-elected Secretary. Members of of the Finance Committee are: L. D. Barney, Alvin G. Brush, Charles D. Doerr, Lyman C. Duncan, Carl K. Raiser, and C. R. Walgreen, Jr.

John E. McKeen, President, Chas. Pfizer & Co., Inc.; T. F. Davies Haines, President, Ciba Pharmaceutical Products Inc.; S. Barksdale Penick, Jr., President, S. B. Penick & Company; and Louis C. Zopf, Dean, College of Pharmacy, State University of Iowa, were elected Directors. George B. Burrus, President, Peoples Drug Stores, Inc.; H. Smith Richardson, Jr., President, Vick Chemical Company; George F. Smith, President, Johnson & Johnson; John J. Toohy, General Manager, E. R. Squibb & Sons, Division of Olin Mathieson Chemical Corporation; Edward T. T. Williams, Chairman of the Executive Committee, Warner-Lambert Pharmaceutical Co., were re-elected Directors.

Ernest H. Volwiler, Chairman of the Board, Abbott Laboratories, was elected a member of the Board of Grants, and Ernest Little, Dean Emeritus, Rutgers University College of Pharmacy, was re-elected. Other members of the Board of Grants are: A. J. Brumbaugh, former President, Shimer College; Daniel Z. Gibson, President, Washington College; and Robert Lincoln McNeil, Founder, McNeil Laboratories, Inc.

L. D. Barney, President, Hoffmann-LaRoche Inc., C. S. Beardsley, Chairman of the Board, Miles Laboratories, Inc., Richard A. Deno, Professor, University of Michigan; Charles D. Doerr, Vice President, McKesson & Robbins, Inc.; H. A. B. Dunning, Chairman of the Board, Hynson, Westcott and Dunning, Inc.; Harold G. Hewitt, Dean, School of Pharmacy, University of Connecticut; Harry J. Loynd, President, Parke, Davis & Company; Robert L. Swain, Editor-in-Chief, Topics Publishing Company; and C. R. Walgreen, Jr., President, Walgreen Drug Stores, were elected members of the Executive Committee, serving with the officers of the Foundation.

A budget of $265,000 was approved by the Board of Directors in support of the educational projects of the Foundation for 1959-60.

The Foundation has provided 1,653 undergraduate scholarships in colleges of pharmacy. During the last academic year, the Foundation provided undergraduate scholarship awards in sixty colleges for 153 pharmacy students.

It has supported the Ph.D. studies of 436 graduate students in pharmacy and related fields, and is currently maintaining seventy-one graduate Fellowships in twenty-nine universities. One hundred and seventy-one Foundation Fellows are now teaching in sixty-six U.S. colleges of pharmacy and twenty-three are serving in professional posts at FDA, NIH, other government services and with professional associations. One hundred and twelve are engaged in research and development work with fifty-four manufacturing chemical and pharmaceutical firms.

The Foundation also supports the American Council on Pharmaceutical Education, annual Teachers' Seminars and the *American Journal of Pharmaceutical Education.*

It administers the E. L. Newcomb Memorial Awards; the S. B. Penick, E. Mead Johnson, Charles R. Walgreen, H. A. B. Dunning, J. K. Lilly, and Charles J. Lynn Memorial Fellowships; and the Gustavus A. Pfeiffer Postdoctoral Memorial Research Fellowships.

The Foundation during 1955-58 provided $110,000 to the American Association of Colleges of Pharmacy in support of its long-range pharmacy student recruitment program. This effort includes two specially prepared color movies for showing to high school and junior college students. The Board approved an additional three-year grant of $50,000 to enable the College Association to continue this important work.

A.Ph.A. awards. The Committee on Public Relations of the A.Ph.A. has announced the winners in the 1959 National Pharmacy Week Display Contest. The Pharmacy College Awards were awarded as follows: The First Prize, consisting of a plaque, was awarded to the Philadelphia College of Pharmacy and Science; the Second Prize, consisting of a certificate of merit, was awarded to the New England College of Pharmacy; the Third Prize, consisting of a certificate of merit, was awarded to the University of Utah.

Texas grant. The Atomic Energy Commission has announced the approval of a grant of $9,763 to the College of Pharmacy of the University of Texas for assistance in procuring aids in nuclear technology. It is expected that a laboratory will be established as soon as possible with the aim of offering a course in nuclear technology to graduate students.

Wisconsin hospital institute. A one-day institute dealing with modern hospital pharmacy practice was held at the University of Wisconsin April 9. The morning session featured presentation of papers by outstanding national leaders in hospital pharmacy on hospital formulary, pricing schedules, narcotic control, and accreditation. Presenting papers were Don E. Francke of the University of Michigan; Grover C. Bowles of the Baptist Memorial Hospital, Memphis; and Joseph Otis, Chicago, staff representative, American Hospital Association. Problems facing hospital pharmacy were considered by afternoon panels, and morning speakers were available for questioning. The institute was sponsored by the Wisconsin Society of Hospital Pharmacists and by the University of Wisconsin Extension Service in Pharmacy.

Eby honored. Dr. Frank H. Eby, Professor of Botany and Pharmacognosy, Temple University, was honored at a dinner April 1 by the Alumni Association of the Temple University School of Pharmacy. In June Dr. Eby will have completed forty years of service to the School of Pharmacy at Temple. Dr. Eby was cited at this dinner for his work in three distinct fields: community service by Louis Wagner, President of the Springfield Township; fraternal activities by Dr. M. L. Neuroth, Grand Regent of Kappa Psi and Professor of Pharmacy at the Medical College of Virginia; academic accomplishments by Dr. Millard E. Gladfelter, Vice President and Provost, Temple University. Dr. Robert L. Johnson, President of Temple University, brought greetings from the University to Dr. Eby.

Rutgers grant. The College of Pharmacy of Rutgers-The State University has received a grant of $10,055 from the Division of Biology and Medicine of the U.S. Atomic Energy Commission to purchase equipment and materials in the school's nuclear technology program.

New building for NDAC. The North Dakota state legislature has appropriated $550,000 for a new building for the North Dakota Agricultural College School of Pharmacy. This money will be supplemented by a National Institutes of Health Facilities Grant of $110,000. Construction of the new building is scheduled to start July 1, 1959, with occupancy anticipated September 1, 1960.

Riegelman at Texas. Dr. Sidney Riegelman, Associate Professor of Pharmacy, U. of California, presented a series of lectures at the University of Texas April 14 and 15 as part of the second annual visiting lecture series. Dr. Riegelman's lectures covered the field of surfactants as they pertain to the manufacture of pharmaceuticals.

Daniels in Japan. Dean T. C. Daniels, University of California, was an invited speaker at the meetings of the Japanese Pharmaceutical Association in Osaka April 7-11. Dean Daniels will also give two seminars at the meetings of the Hawaiian Pharmaceutical Association in Honolulu the week of May 25.

Inaugural ceremonies. The inaugural ceremonies of John B. deC. M. Saunders as Provost and Willard C. Fleming as Vice-Provost of the University of California San Francisco campus were held on March 18, 1959.

California seminars. The following were guest speakers at the Graduate Seminars in Pharmaceutical Chemistry of the University of California: Dr. Adrien Albert, Professor of Medical Chemistry, the Australian National University, Department of Medical Chemistry, Canberra, Australia. Dr. Albert presented two seminars on the topics "A Review of Certain Aspects of Selective Toxicity," and "The Chemistry of Heterocyclic Compounds with Special Reference to Biological Properties." Dr. Carl C. Pfeiffer, Director of Division of Basic Health Sciences, Emory University, spoke on "Acetylcholine and Behavior." Dr. R. Brauer, Head of Pharmacology Branch, United States Navy Research and Development Laboratory, San Francisco, spoke on "Liver Circulation and Liver Function." Dr. Jean Francois Miquel, The Pharmacological Institute, University of Uppsala, Sweden, spoke on "Molecular Structure and Estrogenic Activity in Triphenylethylenes."

Texas lecturers. The list of lecturers and their general topics for the Second Annual Visiting Lecture Series held at the University of Texas College of Pharmacy include Mr. Robert G. Bogash in hospital pharmacy, Dr. Thomas J. Haley in pharmacology, Dr. John E. Christian in chemistry, Dr. Stephen Wilson in pharmacy administration, Dr. Sidney Riegelman in pharmacy, Dean Heber W. Youngken, Jr., in pharmacognosy, and Dr. Rudolph H. Blythe in manufacturing pharmacy.

Guess receives degree. Wallace Guess, Assistant Professor of Pharmacy, University of Texas, received his Ph.D. degree from the University of Washington in February.

Cosgrove compiles formulary. Dr. Frank P. Cosgrove, Assistant Professor of Pharmacy, University of Texas, is cooperating with the Chiropodist Society of Texas in compiling a Chiropody Formulary.

DiGangi studies. Dr. Frank E. DiGangi, University of Minnesota, was a member of the sixty-seventh class in basic techniques of handling radioisotopes given by the Oak Ridge Institute of Nuclear Studies, January 5-31. Of the forty-eight participants from over the world, three were from United States colleges of pharmacy.

Humphrey at Minnesota. On February 27, Senator Hubert H. Humphrey, senior Senator from Minnesota, addressed the students of the College of Pharmacy, University of Minnesota, on world problems. Following the address the Senator was guest of honor at an invitation luncheon attended by students, faculty, and pharmacists.

Fischelis at Minnesota. Dr. Robert P. Fischelis was a guest of the Northwestern and Student Branches of the A.Ph.A. in Minnesota February 18 at the University of Minnesota. Following a dinner on the campus, Dr. Fischelis gave a public address in the auditorium of the College of Pharmacy.

Hager on committee. Dean George P. Hager, University of Minnesota, is serving on the Advisory Committee on Cardiovascular Literature of the National Academy of Sciences.

Howard College president. Dr. Leslie Stephen Wright was inaugurated as the sixteenth President of Howard College April 21, 1959. Retiring President Harwell G. Davis has been designated Chancellor of the College.

College name change. By recent action of the legislature of the state of Washington, effective September 1, 1959 the name of the State College of Washington will be changed to Washington State University.

Farnsworth receives grant. Mr. Norman Farnsworth, Acting Head of the Department of Pharmacognosy, University of Pittsburgh, has received a grant of $3,958 from the Health Research and Services Foundation for a phytochemical study of the leaves of *Vinca major*.

Train at conference. Dr. David Train, Professor, School of Pharmacy, University of London, will be a featured speaker at the First Annual National Industrial Pharmaceutical Research Conference June 14-17 at Land O'Lakes, Wisconsin. Dr. Train's research work has been centered on the mechanism of compaction of powders. Attendance at the conference will be limited to seventy-five pharmaceutical educators and members of the pharmaceutical industry. At the conference nationally prominent speakers from both education and industry will present discussion in fields of specialty. Discussion will include the physics of tablet compression, granulations, and their flow properties, the machines used in these processes and the physical evaluation of the finished tablets. The preliminary program is as follows:

Tablet Compression and Associated Processes

A. Granule Formation
   1. Granule Formation
      a. "Slugging, Extrusion, and Grinding," Dr. Albert Mattocks, College of Pharmacy, University of Michigan
      b. "Air Suspension, Particle Build Up," Dr. Dale E. Wurster, School of Pharmacy, University of Wisconsin
   2. Drying and Drying Control
      a. "Some Theoretical Aspects of the Drying Process," Dr. John L. Tschernitz, Engineering Experiment Station, University of Wisconsin
      b. "Some Experiences with Rotary Vacuum Drying," Jack Cooper, Pharmacy Research and Development, CIBA Pharmaceutical Company
   3. Flow Properties
      a. "Flow Properties of Solids, Some Basic Concepts," Dr. Edwin J. Crosby, Chemical Engineering Department, University of Wisconsin
      b. "Flow Properties of Granules," To be announced

B. Compression
   1. "Forces and Force Distribution," Dr. T. Higuchi, School of Pharmacy, University of Wisconsin
   2. "Lubricants and Effect on Compression Force," Dr. William Strickland, College of Pharmacy, University of Arkansas

C. Formulation
   1. "Binders and Fillers," J. Edward Wolff, Pharmaceutical Research and Development, Sterling-Winthrop Research Institute
   2. Color Formulation
      a. "Colors and Colorants," To be announced
      b. "Color Distribution Techniques," Stan Tucker, Pharmaceutical Research and Development, Smith, Kline, and French Laboratories

D. Physical Evaluation (Panel Discussion)
   1. "Disintegration"
   2. "Friability"
   3. "Hardness"

Buckley moderator. Dr. Joseph P. Buckley, Head of the Department of Pharmacology, University of Pittsburgh, acted as moderator of a symposium on monoamine oxidase inhibitors sponsored by the Pharmacy Research Subcommittee of the Pittsburgh Bicentennial Association. The program participants included Dr. Lowell Randall, Director of Pharmacology, Hoffman Laboratories Inc.; and Dr. Amedeo Marrazzi, Director of the VA Research Laboratories in Neuropsychiatry, VA Hospital, Pittsburgh.

Faculty retreats. As is the annual custom, the entire faculty of the School of Pharmacy, College of Pacific, participated in a faculty retreat to the historic gold mining city of Columbia. In addition to the refreshing break from campus duties, the retreat

provided an opportunity for the faculty to discuss the destinies of the College of Pacific.

Oregon extension service. The School of Pharmacy of Oregon State College has embarked upon a new extension service of taking the school to the practicing pharmacists. Four three-hour seminars have been arranged to be presented in various parts of Oregon.

Patterson honored. Dr. George W. Patterson, Philadelphia College of Pharmacy and Science, who retired from his teaching duties in the department of bacteriology last June after thirty-seven years of service, was the honored guest at the midwinter alumni reunion dinner March 7.

PCP honorary degrees. At the Founders' Day Convocation Philadelphia College of Pharmacy and Science February 19, honorary degrees of Master in Pharmacy were bestowed upon John F. Hinkle, '22, pharmacist in Columbia, Pennsylvania, and Walter F. Hitzelberger, '12, Director of Pharmacy Service of the Los Angeles County General Hospital.

PCP summer institute. A summer institute in radiochemistry will be conducted at the Philadelphia College of Pharmacy and Science for high school and college teachers. It is sponsored by the National Science Foundation and will be held July 6 to August 14.

New journals. Interscience Publishers, Inc. recently announced the publication of the first issues of two new international journals, the *Journal of Medicinal and Pharmaceutical Chemistry* and the *Journal of Biochemical and Microbiological Technology and Engineering*. The editors of the former are Arnold H. Beckett, of the Chelsea School of Pharmacy, Chelsea College of Science and Technology, London, and Alfred Burger, University of Virginia. The aim of this journal (four issues this year) is to be a forum for the presentation of original research and new developments concerning the design and synthesis of medicinal and otherwise biological active chemicals, their metabolism and biological status. The *Journal of Biochemical and Microbiological Technology and Engineering* is to be issued four times a year and has as its aim to gather into a single publishing medium all the papers dealing with the many current and increasingly complex problems requiring biochemical, chemical engineering, and biological knowledge, and to report those processes and techniques wherein biochemical and microbiological phenomena are employed. The editors are E. M. Crook of the Department of Biochemistry, University College, London, M. D. Donald, Department of Chemical Engineering of the same institution, and Elmar L. Gaden, Jr., Department of Chemical Engineering, Columbia University. The annual subscription rate for each journal is $15.

Maryland dedicates building. The University of Maryland's new School of Pharmacy building was dedicated and named in honor of Dr. Henry A. B. Dunning, an 1897 graduate and former associate professor of chemistry at the institution. The new Dunning Hall, a two-story brick and reinforced concrete building ornamented with limestone and granite, is constructed so that it can be expanded in the future by the erection of three additional floors.

O'Malley receives grant. Dr. William J. O'Malley, Medical College of Virginia, has received a grant of $3,000 from Eli Lilly and Company to support research in the field of electroconductivity studies applied to pharmaceutical preparations and antiperspirants.

Richard receives grant. Dr. Alfred J. Richard, Medical College of Virginia, has received a National Science Foundation Grant of $24,000 for research in the field of physical chemistry, particularly the study of degradation products of protein hydrolysis.

Dean Pearson dies. Dr. William A. Pearson, formerly Dean of Pharmacy at Ferris Institute (1904-1906) and later Dean of Hahnemann Medical College (1914-1944), died in his sleep on February 15, 1959. Following his retirement at Hahnemann, Dr. Pearson taught physiology and biochemistry in the General Education Division of Ferris Institute until 1957 when he retired from active teaching.

Ferris grant. The Upjohn Company has renewed a research grant to Ferris Institute in the amount of $2,500 for investigation of the medicinal properties of Michigan plants. Dr. Norris W. Dunham, Dr. Karlis K. Kazerovskis, and Dr. James A. Freck comprise the research committee to utilize the grant.

Kirkland resigns. Dr. W. Dean Kirkland, University of Florida, has resigned as assistant professor of pharmacy to accept a position with Abbott Laboratories.

Wayne survey. Miss Gael Driscoll, an undergraduate in pharmacy at Wayne State University, as part of a requirement for her directed study in hospital pharmacy recently surveyed 100 hospitals, most with greater than 500-bed capacity, regarding the publishing of bulletins or newsletters for institution distribution. Of the approximately fifty replies, thirteen indicated that they were publishing bulletins or newsletters. The survey sought to determine the extent to which hospital pharmacy bulletins or newsletters are published, who assists with the preparation of the publication, to whom distribution is directed, where the bulk of the information is obtained for use in the bulletins and newsletters, and what the major problem is regarding these publications. It was found that, in most cases, hospital pharmacies pub-

lished their bulletins or newsletters with the assistance of people in the respective departments of pharmacy. Information for publication usually appeared to come from manufacturers of pharmaceuticals, pharmaceutical journals, publications from members of the medical staff, and reports of drug evaluations by the Council on Drugs of the AMA obtained from journals. In some instances the bulletins were published as a new drug came into use, or in other cases, the publication was prepared on a monthly basis. Bulletins are distributed, according to the survey, to internes, student nurses, and the regular nursing and medical staffs of the hospitals. Seven out of the thirteen reports indicated that time was the major factor which presented the greatest problem in preparing the bulletins or newsletters.

Hall studies manpower. The Pharmaceutical Foundation of the University of Texas College of Pharmacy has awarded a special grant to Dr. Esther Jane Wood Hall, Assistant Professor of Pharmacy Administration, to conduct a continuation study into the manpower situation in pharmacy in Texas. Dr. Hall completed the first comprehensive manpower study in Texas pharmacy in 1957 in which conclusions were reached that whereas there was considerable improvement in the manpower situation in Texas among pharmaceutical personnel, an intensive recruitment program, predictive tests as part of the college entrance requirement, a more realistic internship requirement, and the utilization of pharmaceutical personnel in activities that fall under the head of professional pharmaceutical service were needed.

Pittsburgh contest. A special essay contest for seventh and eighth grade students of Allegheny County, Pennsylvania, was sponsored in March by the Pharmacy Subcommittee of the Pittsburgh Bicentennial Association. The contest was divided into three sections: city schools, county schools, and parochial schools. First prizes for boys and for girls in each of the sections were twenty-five dollar defense bonds. Cash prizes were awarded to second- and third-place winners, and certificates of merit were awarded to fourth-place winners. There was a total of six first prizes, twelve second prizes, twenty-four third prizes, and forty-eight certificates of merit. Each student who entered the contest wrote a 400- to 750-word essay on "My Friend the Pharmacist." Contestants were able to interview their neighborhood pharmacists to obtain information and to secure available pamphlets and folders. Room teachers from participating schools screened entries and submitted the two best entries, one from a boy and one from a girl. Further screening was done by the English and pharmacy departments of the University of Pittsburgh and Duquesne University.

Conference for advisors and guidance personnel. The third and fourth of a series of dinner conferences sponsored by Columbia University College of Pharmacy for western Suffolk County and Nassau County high school college advisors and guidance personnel were held in February. At the Suffolk County meeting the principal speaker was Dr. Madeline Oxford Holland, Editor of the *American Professional Pharmacist;* at the Nassau County meeting Mr. Louis E. Kazin, Editor of *Drug Topics* and *Drug Trade News,* was the speaker.

New York careers conference. A conference on careers in pharmacy sponsored by the New York Branch of the A.Ph.A. and the four colleges of pharmacy in the City of New York with the cooperation of the High School Division and the Director of Science of the New York City Board of Education was held in March. The purpose of the conference was to acquaint junior and senior high school students with the career opportunities available to graduates of a college of pharmacy. The program included a panel of prominent pharmacists who are active in several areas of pharmaceutical specialization, a practicing pharmacist, a hospital pharmacist, a manufacturing pharmacist, and a pharmaceutical journalist.

Kupchan speaks. Dr. S. Morris Kupchan, University of Wisconsin, addressed the Conference of Plant Chemists at the National Heart Institute, Bethesda, Maryland, in October.

Wurster in Georgia. Dr. Dale E. Wurster, University of Wisconsin, participated in the Research and Development Section of the Pharmaceutical Manufacturers Association at Sea Island, Georgia, in November.

Higuchi activities. Dr. T. Higuchi, University of Wisconsin, gave the Sigma Xi lecture at Fordham University in October and participated in the Research Development Section of the Pharmaceutical Manufacturers Association in November. Dr. Higuchi has launched a new research program in October on the interaction of organic molecules in water which is supported by $30,000 from the Chemical Corps.

Sonnedecker appointed. Dr. Glenn Sonnedecker, University of Wisconsin, has been named an editorial consultant to *Isis,* international review in the history of science, and has been named Corresponding Member by the *Deutsche Gesellschaft für Geschichte der Medizin Naturwissenschaft und Technik.*

Translations bulletin. The Public Health Service, National Institutes of Health, Bethesda, Maryland, is now issuing a *Bulletin of Translations from Russian Medical Sciences* which is available upon request. The primary concern of this publication will be to alert scientists to materials ready for their

appraisal. It will contain announcements concerning the NIH Russian Scientific Translation Program and pertinent information from other programs, government and private.

Schwarting lectures. Dr. Arthur E. Schwarting, University of Connecticut, delivered the annual Julius A. Koch Memorial Lecture at the University of Pittsburgh March 4. His topic was "Legendary Plants and Modern Drugs." The lectureship is sponsored by the Alpha Omicron chapter of Rho Chi Society in honor of the first dean of the Pittsburgh School of Pharmacy.

New AFPE fellowship. An annual fellowship honoring the late Charles Jackson Lynn has been established with the American Foundation for Pharmaceutical Education by the Lilly Endowment, Inc. Mr. Lynn was Vice President and a member of the Board of Directors of Eli Lilly and Company, serving sixty-three years with the company.

Sica elected. Dean Albert J. Sica, Fordham University, has been elected president of the New York Branch of the A.Ph.A.

Grabowski receives grant. Dr. Bernard F. Grabowski, Fordham University, has been awarded a Public Health Service grant by the Mental Health National Advisory Council in support of research in the synthesis of substituted indolines with possible psychopharmacologic interest.

Milio forms company. Mr. Frank R. Milio, formerly of the University of Maryland staff, will open a new pharmacy in Baltimore and also form the Milio Brothers Chemical Laboratories Company, Inc. to market a new line of cosmetics including medicated skin cream, lotion, and sun-tan preparations. The products are available under the trademark "Milzema."

Idaho State receives grant. Idaho State College, College of Pharmacy has been named recipient of a $19,076 grant from the National Institutes of Health to assist in remodeling and modernizing existing research areas in pharmacology, pharmacognosy, pharmaceutical chemistry, and pharmacy.

Poison center at Idaho. The Idaho State Board of Education has approved the development of a poison information center in the College of Pharmacy at Idaho State College. The center will be developed and supervised by Mr. Donald O. Schiffman, Instructor of Pharmacology.

New journal. *Antibiotics* is a new journal-in-translation from the Russian literature published by Consultants Bureau, Inc., 227 West 17th Street, New York 11, New York. It is being published with the financial assistance of Eli Lilly and Company, Inc., Bristol Laboratories, Inc., The Upjohn Company, and Chas. Pfizer and Company, Inc. The journal is published bimonthly with an annual subscription of $25.

HNI film catalog. The Health News Institute recently distributed to colleges, pharmaceutical associations, and other groups a seventeen-page mimeographed catalog of motion picture films produced or sponsored by the pharmaceutical industry. A brief description of each film, including its running time and suggestions as to a suitable audience, is included in each listing. As new information on films comes to the attention of the Institute, supplements to the catalog will be distributed.

Michigan grant. The College of Pharmacy, University of Michigan, has received a $339,500 grant from the National Institutes of Health toward the construction of an $800,000 pharmacy research building. The University is planning to start construction on the four-story building this summer. Its completion is set for the summer of 1960. The remaining $460,500 for the building will be given by foundations, pharmaceutical manufacturers, alumni, and friends of the University. The grant is the largest awarded by NIH to any pharmacy school and will make possible the first building at any university devoted entirely to pharmaceutical research. The building will be devoted almost entirely to laboratories, accommodating from two to four researchers, both faculty and graduate students. Special facilities will also be provided for research and development in areas of industrial pharmacy. Problems dealing with the design of equipment and processes for production of dosage forms will be conducted in the industrial laboratories. A radioisotope laboratory and facilities for research in pharmacognosy will be included in the building.

MCP observes anniversary. On Tuesday, January 13, 250 alumni and friends of the Massachusetts College of Pharmacy attended the observance of the 136th anniversary of the founding of the College. The afternoon meeting was held at the College, on Longwood Avenue, Boston.

Alumni Association President Walter J. Lang, of Wollaston, introduced representatives of local and national pharmaceutical organizations. Represented were the American Pharmaceutical Association, the National Association of Retail Druggists, the Massachusetts State Pharmaceutical Association, the Massachusetts State Board of Registration in Pharmacy, and the American Society of Hospital Pharmacists.

The main speaker of the afternoon was Dr. George F. Archambault (Massachusetts College of Pharmacy '31), of United States Public Health Service Headquarters in Washington, D.C. Dr. Archambault is Chief of the Pharmacy Branch, Division of Hospitals. Recently returned from a European tour as a representative of the U.S. Surgeon General's Office, Dr. Archambault discussed the future of pharmacy in the United States in the light of many changing

world factors. In considering Europe's new common market, launched January 1, 1959, an association of six nations, France, Germany, Italy, and the three Benelux countries (Belgium, Netherlands, and Luxemburg), he predicted "mass production, such as made in the U.S.A., being possible on the European continent within fifteen years, as a result of a common tariff, common wage and tax levels, and interchangeability of workers. World statesmen have long hoped for a united continent. This could be a start . . . 450,000 square miles and 163 million people are involved."

Continuing with a cogent review of social legislation and national trends affecting the health sciences, he said "the American people are and will be insisting more and more on the right to purchase their normal medical care in a better, more convenient package than in the past; a one-stop package, if you please, where they receive laboratory work-up, X-ray and prescription service under the same roof where they are diagnosed and treated."

Following Dr. Archambault's address, an informal reception and buffet was held in the Sheppard Library.

Wisconsin recruitment drive. An all-out Pharmacy Recruitment Drive has been instigated by the University of Wisconsin School of Pharmacy. The Wisconsin Pharmaceutical Association and UW School of Pharmacy are jointly sponsoring this expanded program which is outlined as follows:

1. The January issue of the *Wisconsin Druggist* (monthly journal of the W. Ph.A.) featured recruitment. President William Koch devoted his editorial to the problem and articles by members of the School faculty will stress the importance of recruitment to practicing pharmacists.
2. Two days following the mailing of the *Wisconsin Druggist*, every pharmacy in Wisconsin received a counter card containing several pamphlets telling of the opportunities of a career in pharmacy. Every pamphlet contains a return card which, when returned to the School of Pharmacy, will be processed on an individual basis.
3. At the same time every high school principal, guidance director, and chemistry teacher was mailed several of these recruitment brochures for their use in counseling students.
4. A noon-to-noon counseling service for high school and college students interested in a career in pharmacy was conducted in conjunction with the annual Pharmacy Management Institute. These students were sponsored by Wisconsin pharmacists and attended a special program devoted to introducing them to the various opportunities in pharmacy while their pharmacist sponsors are attending the Management Institute.
5. Several meetings have been scheduled throughout the state to which pharmacists, educators and students have been invited. Presenting the program will be members of the pharmacy school staff.
6. The Seventy-fifth Anniversary Scholarship fund drive will also be completed in the first quarter of 1959. This fund will be used for undergraduate scholarships and grants, especially to attract and support needy and qualified high school students entering prepharmacy.

This program, having been tested December, 1958, was found to be successful.

Pharmacist exchange. An invitation to young American pharmacists and pharmacy students to participate in the 1959 Student Exchange Program has been issued by the International Pharmaceutical Students Federation. The program offers an opportunity to obtain experience in the way of life and the pharmacy of other lands.

Through its Committee on Student Exchange the Federation will help arrange for young Americans to go to a foreign land to work or observe in a pharmacy. Pharmacists who have graduated within the past seven years, as well as pharmacy students, are eligible for the program. There are likewise pharmacy students or recent graduates overseas who are eager to know America better, and pharmacists who would be interested in being host to one of these young colleagues for one to several months are being sought. The host pharmacist would be expected to pay a salary at least covering living expenses of the visitor-employee of his choice. The young person going overseas provides his own passage fares. Exact arrangements are worked out by the two parties concerned once contact is established, the Federation points out.

The exchange program has been developed with the idea that it will not only offer a stimulus to the profession and participating individuals, but in its own way will encourage better international understanding.

Pharmacists or students interested in the program may obtain further information and application blanks from: Dr. Jerome A. Reinstein, U.S. Liaison Secretary, IPSF, Chas. Pfizer & Co., Inc., 11 Bartlett Street, Brooklyn 6, New York.

The following categories of participants in the program have been set up:

I. Exchange Categories

A. *Those wishing to work* in retail or hospital pharmacy for a period of one to three months. Usually the period is one month. (Working students must have completed a year's practical experience.)

B. *Those wishing to observe* the work in a pharmacy and the pharmacy students' way of life in another country.

II. Reception Categories

A. *Pharmaceutical families, i.e.,* a family where a parent is a pharmacist and a son or daughter is a pharmacy student. If the latter so desires, a direct exchange with the student being visited will be arranged (before or after the visit).

B. *Pharmacists* without sons and daughters in pharmacy who, nevertheless, would be willing to allow a foreign pharmacy student to work in their retail or hospital pharmacy or manufacturing establishment.

C. *Pharmacy students* who are in a position to entertain foreign students. Again, if the host student so desired, every effort would be made to effect a direct exchange.

Student Congress. The IPSF has issued an invitation to all pharmacy students and recent graduates to attend its VI Congress, which will be held at Noordwijk on Sea, The Netherlands, from September 5-15, 1959. Accommodations at this beautiful Dutch North Sea resort will be in rooms with two to six beds, and a large lounge will be at the disposal of the participants. The program includes general meetings, excursions, social evenings, council meetings, films, and a farewell dinner. The all-inclusive charge for the full 10 days is only $38.50.

All young pharmacists and students who will be in Europe this summer are urged to include this Congress in their plans. Those who have attended previous IPSF meetings have unfailingly called them wonderful experiences they will cherish for years. One leaves having made lasting friendships with future pharmacists from all over the world.

The detailed program will be available shortly. Those interested should send a letter of application, to: Mario van Geijn, Secretary, Rapenburg 47, Leiden, The Netherlands.

At the time of application, it is necessary to send a deposit of $7.00 to: Amsterdamsche Bank, Leiden, Netherlands. Please make checks or money orders payable to: Conto Jonkers c/s Congress.

North Carolina foundation. The annual meeting of the Board of Directors of the North Carolina Pharmaceutical Research Foundation was held at the University of North Carolina School of Pharmacy Wednesday, February 4. A luncheon for the directors, UNC officials, and the pharmacy faculty was held. The organization was founded in 1946 by the pharmacists of North Carolina through the North Carolina Pharmaceutical Association. The purpose of the foundation is to promote pharmaceutical service to the state and the South through the UNC School of Pharmacy. Dr. E. A. Brecht, Dean of the UNC School of Pharmacy and secretary of the foundation, said the organization had one of its best years during 1958. Dr. Brecht reported that during the twelve years of the organization's existence, a total of $276,000 had been received. Of this, some $68,000 had been expended by the School of Pharmacy for scholarships and fellowships, research supplies, special equipment, library materials and other needs of the Pharmacy School. At the present time the foundation has assets totaling $198,000. Of this sum $167,000 is in endowments, and the remainder, $31,000, is in expendable funds. During the past twelve years, only $10,000 has been used as operating expenses by the foundation.

PMA statement. In a 1,000-word Statement of Principle, the Pharmaceutical Manufacturers Association warned that the U.S. faces a 25 per cent deficit in the number of medical scientists needed by 1970. Therefore, the association said, the government must also give highest priority to programs which would lead to the training of additional teachers and researchers. The PMA said that pharmaceutical industry laboratories should not receive government subsidies except for those "exceptional cases" in which U.S. agencies cannot find a nonprofit institution capable of turning out the required research. As a matter of fact, the PMA declared, research subsidies to drug firms rather than to academic institutions would probably result in further depletion of an already-dwindling supply of scientists in nonprofit centers. The PMA said its "Statement of Principle on Government Support of Medical Research" will be mailed to members of Congress, White House advisers on science, and to leading researchers and medical educators. A number of points in the PMA statement were elaborations on the findings of a recently disbanded top-level government advisory committee, the "Consultants on Medical Research and Education to the Secretary of the Department of Health, Education and Welfare." This committee is generally called the Bayne-Jones Committee after its chairman, Dr. Stanhope Bayne-Jones, formerly dean of the School of Medicine, Yale University.

The Pharmaceutical Manufacturers Association quoted the Bayne-Jones Report in pointing out the phenomenal growth of government support to medical research—from a scant $3 million in 1940 to an estimated $227 million in 1958.

"The pressures upon the Congress and upon federal agencies for practical results are apparent," said the PMA statement, "and unquestionably will increase in direct relation to the size of the expenditures. But as the Bayne-Jones Report states, 'pressures for practical results cannot be allowed to supersede the fundamental kind of studies which, over the long-run, produce revolutions rather than merely improvements in health standards.'"

Since it is the nonprofit research institution which, by its very nature, deals with basic studies, it is these centers rather than

the drug industry's laboratories which should receive federal support. Moreover, it is the nonprofit research institution which serves as the training center for all medical scientists—whether they subsequently turn their attention to applied or to basic research.

Explaining the pharmaceutical industry's function in the nation's medical research picture, the PMA pointed out that the industry in 1958 spent "at least" $170 million on research. Some of this went for basic investigations, but the bulk of it—by the very nature of the drug industry—was highly advanced scientific research whose direct aim was to find "clinically useful products."

But, said the PMA, whether in industry's laboratories or in academic laboratories, "the paramount problem is undoubtedly the critical shortage of scientific personnel. The extent of the personnel shortage is well documented: The Bayne-Jones Report indicated that 25,000 additional scientists will be needed by 1970, but that present training facilities will provide only 19,000. . . .

"Government subsidies for industrial research will still further accentuate this manpower problem," the PMA statement went on. "It must be recognized that there are only three ways by which a pharmaceutical firm can staff a government-subsidized project. The first is to divert its own scientists from projects on which they are already working. The second is to obtain additional personnel from other firms, which results in a wasteful pattern of raiding. The third—easiest, but most destructive—is to obtain the needed people from academic life, thus depleting still further the supply of teachers and scientists engaged in basic research."

On the question of government-industry "crash" medical research programs, the statement recognized that the PMA stand is contrary to "the current trend . . . in electronics, aircraft and other fields of research." But the critical manpower needs—and above all, the critical need to build up academic centers—indicates the wisdom of subsidization only "where no nonprofit institution can do the job."

"In such exceptional cases, however, full cooperation can be expected from a pharmaceutical firm approached by the federal government because of its unique qualifications," the PMA declared.

One of those exceptional cases, said the PMA statement, is the current government-industry cancer chemotherapy program, in which the National Institutes of Health has made grants to various pharmaceutical firms to participate in an experimental mass-screening program of all types of chemical agents. Here, said the PMA, subsidization can be considered justified "in view of the lack of leads after so many years of effort and the nature of the 'problem.'"

"In fields other than cancer," the PMA said, "the pharmaceutical houses are pushing the search for new drugs with adequate funds and with every means at their disposal in the light of present knowledge. It is our basic knowledge that needs to be increased as rapidly as possible, and federal funds should be channeled to academic institutions which need them to support and expand their basic research."

AAAS meeting. Pharmacy Section Np held eight sessions December 26 through December 29 in Washington, D.C. A total of thirty contributed papers on original studies was reported, and two symposia were held. Over 250 persons registered as having attended one or more of the Pharmacy Section meetings.

The AAAS Council, the governing body of the Association, elected Dr. Glenn L. Jenkins, Dean, School of Pharmacy, Purdue University, as a Vice President of the Association and elected Dr. John Autian, School of Pharmacy, University of Michigan, to serve on the Committee at Large of the Section for a four-year term. Dean Jenkins will serve as Chairman of the Section for the coming year and will preside at the Chicago meeting.

Of major interest to the group in attendance was a most stimulating vice presidential address on "The AAAS and Pharmacy" presented by Dr. George Archambault. Dr. Archambault set forth the major objectives of the Section as follows:

(1) To promote and encourage scientific advancement in the pharmaceutical sciences along with and as a part of the general scientific progress of the nation.

(2) To secure a more widespread recognition of our profession as a science in meeting with other scientific disciplines.

(3) To provide a meeting ground for individual recognition of pharmaceutical scientists by other scientists of the nation.

Dr. Archambault stated, "I have strong hopes that through this Section, researchers in the pharmaceutical industry will release some of their more important 'breakthrough' research papers, especially those concerned with the introduction of new drugs."

A symposium on "Advances in Conquering Cancer" attracted considerable interest outside the pharmaceutical scientists in attendance. Dr. Stuart Sessoms, Assistant Director of the National Cancer Institute, gave an introduction to the problem and served as the presiding officer over the session. Dr. T. Phillip Waalkes, Special Assistant to the Chief, National Cancer Chemotherapy Center, National Cancer Institute, gave a review of promising drugs in this field, and Dr. Milton Skolaut, Chief, Pharmacy Department, Clinical Center NIH, discussed the impact of cancer research on the hospital pharmacy program. Dr. Roderick Murray, Director, Division of Biologic Standards, NIH, spoke on the function and responsibility of the Division of Biologic Standards of the National Institutes of Health. This program was followed by a tour of the Chemical Center of the National Institutes of Health.

In addition to the above-mentioned program, the hospital pharmacy group had a most informative and well-attended full-day session under the guidance of Dr. G. F. Archambault and J. A. Oddis. The following organizations were represented: American Society of Hospital Pharmacists, American Pharmaceutical Association, Maryland Association of Hospital Pharmacists, District of Columbia Pharmaceutical Association, American Hospital Association, Howard University, and George Washington University. Several important subjects of direct interest were discussed, including a fluid form of Meprobamate, research potential in hospital pharmacy, and statistics as a research tool. A symposium on the hospital pharmacist of the future included the following participants: William S. Apple, Charles U. Letourneau, Charles W. Bliven, Kenneth Nelson, and Joseph A. Oddis. Luncheon, entertainment, and dinner were sponsored by E. R. Squibb & Sons, Mead Johnson and Company, and McKesson and Robbins, Inc., respectively.

Dr. Justin L. Powers, Editor, *Scientific Edition, Journal of the American Pharmaceutical Association*, opened the contributed papers sessions which consisted of the presentation of the results of original research. The papers presented were of unusual merit. Dr. Joseph V. Swintosky and coworkers at the Smith, Kline and French Laboratories in Philadelphia presented a series of three papers dealing with the problems of sustained release medication. The effect of orally administered thiourea in rats was discussed by Dr. A. H. McCreesh of Temple University. Dr. A. G. Roberts, J. B. Roerig & Company, presented a paper on the pharmacological prediction of hydroxyzine hydrochloride activity. W. J. O'Malley, Medical College of Virginia, and J. E. Christian, Purdue University, discussed the design of a continuous recording *in vivo* method of measuring sensible perspiration. Methods of determining compression characteristics of materials as an aid to tablet formulation were presented by Dr. L. L. Kaplan and Dr. J. E. Wolff of the Sterling Winthrop Research Institute. Dr. J. J. Sciarra, St. John's University, discussed the solubility of boric acid solutions and a qualitative analytical procedure for borates.

Other papers presented, "Linear Titration Curves of Acids and Bases," "Meprobamate Synergy With Other Muscle Relaxants," "Flavor Comparisons of Cocoa Syrups," "Water Soluble Carbohydrates of the Opium Poppy," and "Spectrophotometric Assay for Acetylsalicylic Acid and Salicylic Acid" were delivered by Dr. N. R. Joseph, University of Illinois; Dr. James W. Ingalls, Jr., Brooklyn College of Pharmacy; Dr. M. Stutesman, Ferris Institute; Dr. Einar Brochmann-Hanssen, University of California; and Dr. L. A. Springman, Eli Lilly and Company, respectively.

The sessions ended with an evening tour of the American Institute of Pharmacy which serves as the headquarters of the American Pharmaceutical Association. The tour was arranged by Dr. Robert P. Fischelis, Secretary of the Association.

Pharmacy's organizations are responsible for every great advance the profession has made.

Hugh C. Muldoon, Am. J. Pharm. Ed., 6, 189 (1942)

BOOK REVIEWS

Mechanism of Inorganic Reaction, Fred Basolo and Ralph G. Pearson, John Wiley and Sons, Inc., New York, New York, 1958. xi + 426 pp., 73 figs., 70 tbls. $11.75.

Research chemists, teachers of chemistry, and graduate students of chemistry owe a debt of gratitude to Drs. Basolo and Pearson for writing this timely and unique volume. The remarkable volume is timely because of the increased interest that is being shown currently in theoretical inorganic chemistry. It appears that previously no other volume has been devoted entirely to the general area of the solution chemistry of metal complexes.

The lucid style of this book is supported by excellent typography. Equations, figures, tables, and illustrations are clear and well explained. Most of the figures appear to be based directly on the original literature, reference to which is cited. For a moderately short book, the authors were doubtless wise in avoiding any detailed discussion of such topics as gas phase reactions, solid state reactions, etc. Moreover, the authors' selective approach enabled them to treat comprehensively the mechanism of inorganic complexes in solution, a subject for which the authors show familiarity and understanding. In the preface of the book, the authors mentioned justifiably that the readers of this book should be adequately trained in the fundamentals of chemistry and in addition have some prior knowledge of coordination chemistry stereochemistry, and reaction kinetics.

The first chapter is a brief introduction and summary of coordination chemistry. The second discusses the three current theories of the coordinate bond, *viz.*, (1) the electrostatic theory, including crystal field corrections, (2) the valence bond theory, and (3) the molecular orbital theory. The next five chapters cover in great detail the mechanism and kinetics of substitution reactions, isomerization and racemization reactions, and electron transfer or oxidation-reduction reactions. Chapter 8 presents an excellent classification of the catalytic effects of coordination compounds. Chapter 9 entitled "Miscellaneous Topics" treats briefly some subjects of recent interest, *viz.*, the absorption spectra of complex ions, "outer sphere" complexes or ion pairs, acid-base properties of complex ions, and exchange reactions.

It is the feeling of the reviewer that the authors have, in the main, achieved their purpose although one could wish that a more thorough treatment could have been given to the miscellaneous topics which are some of the new frontiers in inorganic chemistry. However, the reviewer feels sure that this book will help markedly in raising inorganic chemistry to the position it so richly deserves.

I would recommend this volume as a reference book for a pharmacy library. This book should prove invaluable to all persons interested in the mechanisms of inorganic reactions in solution.

Ray F. Wilson
Texas Southern University

Theoretical Principles of Organic Chemistry, Volume 2, Walter Hückel. Translation by F. H. Rathmann from the Seventh German Edition. D. Van Nostrand Company, Inc., Princeton, New Jersey, 1958. xi + 1046 pp., 86 figs., 148 tbls. $19.00.

This volume is made up of two books. Book III, "Constitution and Physical Properties," is composed of Chapters XI through XVII. Book IV, "Constitution and Reaction Velocity," is composed of Chapters XVIII through XX. The first ten chapters are to be found in Volume 1 composed of Book I, "The System of Organic Chemistry. Symbolism. Chemical Statics," and Book II, "Limits of the Customary Symbolism of Organo-Chemical Systematics. Chemical Dynamics."

This is an excellent treatise for general background and discussion of many modern concepts for the student of theoretical organic chemistry. Of course, as is to be expected in a book covering a field in which there has been such rapid progress, some topics are discussed better in other publications. The treatment of older principles is such that it serves to orient the student in the study of current theory, and the material is presented so that it can be understood by those with an average background in mathematics and physical chemistry. The range of subjects discussed is very broad. There are extensive references covering the literature as late as 1955.

In the opinion of this reviewer this book is such that it will not find a place as a text in courses in pharmaceutical chemistry, but it will prove valuable as a reference for some subjects considered. It would be a good addition to a library. It should prove outstanding among textbooks in organic chemistry.

L. G. Gramling
University of Florida

Polysaccharides in Biology, Transactions of the Second Conference on Polysaccharides in Biology sponsored by the Josiah Macy, Jr. Foundation, George F. Springer, Editor. Madison Printing Company, Madison, New Jersey, 1957. 245 pp., 54 figs. $5.00.

In this volume, the transactions of the Second Conference on Polysaccharides in Biology, the stimulation and high standards of the First Conference on Polysaccharides in Biology are continued. The aim of the book is to provide an opportunity for reporting informal discussions among participants who are well prepared to discuss problems in their field. The three important areas discussed include "Sialic Acid and Related Compounds," "Interaction of Polysaccharides and Viruses," and "Pyrogens." Each section consists of pertinent coverage of important concepts under study today. These discussions were led by foremost researchers in the field of medical sciences. The interchange of ideas reported sometimes wanders but is unusually pointed and stimulating. The give-and-take approach is well adapted to the present discussions and for pinpointing areas for future research. The technique, although not commonly followed in books, gives the reader a chance to analyze information, and stimulates evaluation of the work presented.

The discussion of "Sialic Acid and Related Compounds," led by Friedrich Zelliken, Department of Biochemistry, University of Pennsylvania School of Medicine, includes animal sources, species variation, and physical and chemical characteristics. Frank L. Horsfall, Rockefeller Institute for Medical Research, moderated the discussions concerning "Interaction of Polysaccharides and Viruses." Discussions were centered upon the difficult and little-understood topic of so-called inhibitors in hemagglutination. Questions upon which attention was centered include: in vitro reactions; chemical nature of inhibition, receptor on erythrocyte and viral reactions; absorption of virus by cells; enzymatic relationships with inhibitors as virus enters a susceptible cell; and enzymatic relationships as the virus reproduces and subsequently is released through the cell membrane. Few answers were forthcoming, but many of the questions are more sharply delineated and continued research should be more productive because of the information related. Discussions concerning "Pyrogens" were led by Otto Westphal, Dr. A. Wander Research Institute, Freiburg-Zähringen, Germany. The difficulty in obtaining chemically pure substances for studies involving induction of fevers is reiterated often in the report, yet ingenious methods are suggested for purification of the chemicals to be studied. Pertinent graphs and illustrations aid the reader in following this discussion.

The figures are adequate, many of them summarizing understandings to date or materials ready for publication. The discussions make it possible for the reader with a little imagination to be present at the meetings. Each section contains a complete list of references. These will be important to any advanced student working in the field. The book should be on the desk of any researcher in the field and in the library of schools of medicine and pharmacy. It is a fine contribution to the field of applied biology.

Leland P. Johnson
Drake University

Formulary of Perfumes and Cosmetics, R. M. Gattefosse. Chemical Publishing Company, New York, New York, 1959. xiii + 252 pp., 8 tbls. $6.50.

This is the first American edition of this formulary and is intended as a guide to the neophyte perfumer and cosmetic chemist. To this end the author presents series of formulas for perfume types and cosmetic classes. The book is a translation from the French.

The first section, which comprises the major portion of the book (166 pp.), deals with perfume formulation. Although it purports to "lay a solid foundation for the art of perfumery" it falls far short of this goal. Not only does this section supply a good deal of misinformation such as equating bergamot with orange or classifying coumarin as an alcohol, but it also refers to such meaningless or indefinite components as jasmine base, synthetic peach, lavender absolute in solvents, ylang-ylang portion, etc. Antique designations such as glycerine for wistaria and visnage are used.

The purposes of this section of the book would have been better served if the author had contented himself with presenting some starting formulas as a guide, leaving room for individual creativity on the part of the perfumer. Instead we find finished formulas which are, too often, erroneous, misleading, antique, incomplete, and indefinite.

This section also suffers from the presence of obvious typographical errors, indicating that a poor job of proofreading was done if such was attempted at all.

The remaining section of the book is a "formulary of cosmetology" which is supposed to provide a source of information for manufacturers for whom it purports to supply "all the elements of serious profitable manufacture." No established cosmetic manufacturer would value much of the information in this section, while for the novice it can only be termed misleading.

The classification system used to present the various cosmetic products is disorganized and obscure to any American cosmetic chemist. Such classes as fatty milks, carbohydrate creams, creams for sports, marine creams, and toilet vinegars are hardly current designations or important types of cosmetics in this country.

Probably the most offensive information here is contained in the therapeutic claims loosely made for the cosmetics discussed.

The most flagrant example of this is contained in the section on aromatherapy where aromatic solutions are given such enchanting designations as vitalising lotions, tonic lotion, vasomotor lotion, and lotions for under- and over-developed breasts. The properties claimed for these as well as for many of the other formulas contained in this section are from another century and, if made in this country, would do nothing more than provoke the righteous ire of the Food and Drug Administration. The author has successfully ignored all of the scientific literature of the last several decades in preparing this formulary.

References are used by the author when he feels the inclination and omitted when he so desires. One work referred to as recent is almost twenty years old.

The work is made even more undistinguished by the efforts of the translator. One statement obscured by translation is "All modern wetting agents are contaminants for emulsions with a continuous water phase." Another example of similar treatment is "It will be seen that as further instructions are adumbrated the formulae became more and more schematic." Neither of these statements makes additional sense when read in context.

The book contains no bibliography nor any modern examples of cosmetic formulas. It is not possible to recommend the volume to any group or library in this country, especially in light of the availability of the several excellent modern works in perfumery and cosmetics.

Leonard Chavkin
Columbia University

Chemical Transformation by Microorganisms, Frank H. Stodola. John Wiley and Sons, Inc., New York 16, New York, 1958. ix + 134 pp., 2 figs., 6 tbls. $4.25.

This volume is the second of a series based on the E. R. Squibb Lectures on Chemistry of Microbial Products presented at the Institute of Microbiology, Rutgers University. Accordingly it reads much like a lecture in that it is greatly condensed so that a treasure chest of data on chemical transformations wrought by microorganisms could be presented in a limited time.

The first chapter deals with an introduction to the "Chemical Anatomy of Microorganisms with Special Reference to *Mycobacterium tuberculosis.*" In reality it is little more than a chronicle of the work in the field of the morphological and cytological chemistry of microorganisms. A bibliography of 112 references is so well selected as to provide some of the better work in the field through 1958. The author's failure to either criticize or discuss any of the data he catalogs is understandable in a lecture but greatly reduces the value of the book. The title of the first chapter leads the reader to expect some critical presentation regarding *Mycobacterium tuberculosis;* but what is actually given is eleven pages of gross chemical analysis and three pages barely touching on the chemistry of the structures of the cell. While most of this is quite current, the chronological approach provides little explanation, discussion, or criticism of the work; and this in a field where critical evaluation has been so necessary.

In Chapters 2 and 3 the author's attention turned to the presentation of examples of "Organic Type Reactions" carried out by microorganisms as well as of the "Synthetic Powers of Microorganisms." Both chapters are expositions in which the various types of reactions are listed and one to several illustrations given along with structural formulas or equations.

Not until the last twenty pages of the book does the author show his ability to write well. His presentation of the development of microbiological methods for the preparation of alpha-ketoglutaric and glutamic acids as well as the gibberellins brings together for the first time in a fascinating manner work which has appeared in journals scattered by time and distance.

A total of 289 references make this book a valuable bibliography for all interested in microbial chemistry. For the organic and the biological chemists this book emphasizes clearly the value of utilizing bacteria, yeasts, and molds for synthetic processes as well as for specific chemical transformations.

Leon J. Le Beau
University of Illinois

Handbook of Treatment of Acute Poisoning, E. H. Bensley and G. E. Joron. Second Edition. E. and S. Livingstone Ltd., London, England (The Williams and Wilkins Co., Baltimore, Maryland, U.S. agents), 1958. xii + 212 pp. $4.00.

The authors have accomplished in this small but comprehensive handbook their literary aim, i.e., to furnish a guide to the medical treatment of poisoning. Bensley and Joron have provided a practical and workable outline of emergency measures to be followed by the physician in crises resulting from acute toxicity. Discussions of chronic poisoning are intentionally ignored, and only superficial and incidental references are made to such cases.

Written in large, clear type, the readable text is divided into two main parts. Section I is concerned with the basic principles of first aid and provides a discussion of the specific and generalized methods employed in the treatment of acute toxicity. Section II, the bulk of the text, consists of brief, but relatively thorough reviews of the more common poisons that the physicians will be called upon to antidote.

The poisons are alphabetically arranged in the text; a short list of synonyms, chemical analogs, or names of commercially available products containing the toxic substance as an active ingredient, follows each title. The most common avenue of poisoning is given

for each poison together with its mode of action. In addition to acute symptomology, the distribution, metabolic fate of the toxic agent, and the cause of potential fatality are outlined. Finally, the authors enumerate concisely the first aid measures to be given the patient prior to the arrival of the physician, followed by the emergency pharmaco- and physiotherapeutic measures to be administered by the doctor.

The contents of a recommended emergency poison kit for the physician are listed in a short appendix together with a sketchy note on the proper collection and preservation of toxicological samples for chemical identification; a short bibliography is also appended.

The statement on page 189 that "strychnine is widely used in medicine . . ." is undoubtedly exaggerated and should be modified in future editions. A method is given on page 204 describing the preparation of a 1:10,000 solution of potassium permanganate; actually, this procedure gives a final concentration closer to 1:8,000.

Although written primarily for the general practitioner's use, this compact and clearly written book should find a home in pharmaceutical and medical libraries. Pharmacy upperclassmen will find this handbook a valuable asset to their pharmacology background and an important reference for later use in the everyday practice of pharmacy.

Paul V. Buday
Fordham University

Progress in Organic Chemistry, Volume 4, J. W. Cook, Editor. Academic Press, Inc., New York 3, New York, 1958. ix + 256 pp., 17 figs., 17 tbls. $8.80.

Volume 4 of *Progress in Organic Chemistry* consists of six chapters, four of which deal with natural products, one with theoretical organic chemistry, and one with heterocycles containing Group V elements. In accordance with the aims set forth by the editor, in the first volume of this series, the authors of Volume 4 make no attempt to give an exhaustive account of all work done in the given field but rather give a concise survey of recent developments in the field. This is clearly demonstrated by the fact that about 70 to 80 per cent of the references cited in most chapters are more recent than January 1, 1950. The literature appears to have been well covered for the period 1950 to 1956 inclusive, and a few early 1957 references are included. The authors are to be commended for having made their reviews as up-to-date as possible.

Chapter 1: "Naturally Occurring Unsaturated Fatty Acids" by F. D. Gunstone, 30 pages, 151 references. In this review the emphasis is on stereospecific synthetic methods and on recent advances in stereochemistry of unsaturated fatty acids. Only acids of eight or more carbon atoms are considered. The emphasis is on compounds which have been reported in recent years and those about which additional information has recently become available. Special consideration is given to advances in the chemistry of acetylenic acids and those containing cyclo-alkane or cyclo-alkene rings. This chapter will be greatly appreciated by teachers and students of chemistry of natural products.

Chapter 2: "Free Valence in Conjugated Organic Molecules" by B. Pullman and A. Pullman, 40 pages, 155 references. This chapter treats of a relatively new concept in theoretical organic chemistry by authors who are among the original proponents of the concept. The notion of free valence is used to interpret and predict chemical reactivity of carbon atoms in aromatic hydrocarbons and physico-chemical properties of substituted aromatic hydrocarbons. Medicinal chemists interested in carcinogenic aromatic hydrocarbons should find this chapter of special interest. An error was noted on page 57 where the Ka of aniline is given as 3.8×10^{-10} and those of aliphatic amines as 10^{-4} to 10^{-5}. Obviously what is meant is the Kb of these bases.

Chapter 2: "Oxygen Heterocyclic Fungal Metabolites" by W. B. Whalley, 43 pages, 72 references. Chapter 3: "Naturally Occurring 2-Acylcyclo-hexane-1:3-Diones" by C. H. Hassall, 25 pages, 80 references. The emphasis in these two chapters is on structure determination and synthesis of the natural products in question. Compounds treated in Chapter 3 have been isolated from kousso, from resins of the male fern and hops, and as constituents of certain essential oils. Although these two chapters have relatively limited scopes, they treat of a number of chemical reactions of general applicability and thus constitute a valuable compilation of data for investigators in these and related fields.

Chapter 5: "Degradation and Synthesis of Peptides and Proteins" by A. H. Cook and G. Harris, 77 pages, 484 references. This is an excellent review of recent advances in a rapidly expanding field. The fact that 80 per cent of the some 500 references cited are more recent than January 1, 1950, gives an indication of the scope of recent investigations in this field. A brief survey of methods of purification is given, but the emphasis is on the determination of amino acid sequences and the selective synthesis of polypeptides. This chapter will be greatly appreciated by biochemists, medicinal chemists, and by teachers and students of chemistry of natural products. It was noted that on page 194 that the structure of the nitroguanidine group is given as nitramine while the tautomeric nitrimine form would be more correct.

Chapter 6: "The Heterocyclic Derivatives of Phosphorus, Arsenic, and Antimony" by F. G. Mann, 32 pages, 65 references. The emphasis in this chapter is on synthetic methods of heterocycles in which the heterocyclic ring consists solely of the Group V elements and carbon. That this is still a

somewhat selective field is indicated by the fact that almost two-thirds of the references cited are from the author's own publications.

In keeping with the policy and standards of the preceding volumes of this series, the reviews in Volume 4 have been prepared by authors who are actively engaged in work in their respective fields. This authoritative book certainly deserves a place in every pharmacy library.

Alain C. Huitric
University of Washington

Mathematics and Statistics for Use in Pharmacy, Biology, and Chemistry, L. Saunders and R. Fleming. First Edition. Published under the direction of the Council of the Pharmaceutical Society of Great Britain. Pharmaceutical Press, London, England (Distributed by Rittenhouse Book Store, Philadelphia, Pennsylvania), 1957. x + 257 pp., 62 figs., 23 tbls. $4.75.

A study of this book will show the importance of the role that mathematics plays in the sciences. Mathematics is both the "handmaiden" and the "queen" of the sciences for its role is great and diversified. This book can be recommended as a valuable addition to any pharmacy college library as a good reference book on mathematics as an area of human knowledge, which in the main has been overlooked but should have a greater role in the pharmaceutical curriculum. Mathematics is taught, by necessity, in a step-by-step fashion in which the learner must comprehend each step in order to master the succeeding step. Therefore there is a definite limit to the amount that can be taught in a given period under given conditions. But since this book touches upon so many complex subjects in such a limited space, it is not likely to give the undergraduate reader a working knowledge of either mathematics or statistics. The extreme brevity throughout the book results in inadequate explanations, illustrations, and problems necessary for undergraduate student comprehension.

This book has been divided into fifteen chapters. The topics discussed include two chapters on arithmetic and algebra. Chapter 3 introduces analytical geometry with curve forms, and the graphical solution of equations. Chapter 4 covers series, permutations and combinations, the binominal theorem, and natural logarithms. The next three chapters present the rudiments of differential calculus, the higher derivatives, partial differentiation, and rules of integration. This is followed by a chapter on trigonometry including trigonometric functions and their differentiation and integration. Chapter 9 deals with differential equations of the type applicable to chemical reactions, radioactive decay, and diffusion. Chapter 10 leads into a discussion of equations and series for describing experimental measurements.

The remaining five chapters deal with statistics, in each case with a discussion of elementary theory followed by one or more applications in biology, chemistry, or pharmacy. Beginning with the probability concept, the authors discuss the binomial, normal, and Poisson distributions. Following this, in a chapter on the statistical analysis of repeated measurements, the mean, standard deviation, and limits of error are considered. In one chapter on comparison of data by statistical methods and tests of significance, the authors cover in rapid succession the normal deviate test, the t test, the variance-ratio or F test, the x^2 test, regression, and correlation coefficients. In Chapter 14 some applications of statistics to biological assay and bacteriology, and in Chapter 15 some applications of statistics in pharmacy complete the text. A series of thirteen appendices contain derivations of some important relations and reference tables.

As a mathematician, teaching in a college of pharmacy, I was quite naturally interested in reviewing this book. The authors are to be complimented upon their accomplishment in assembling into one small volume the great variety of mathematical topics needed in the pharmacy curriculum and for recognizing the need for the correlation of the material on that subject, but from the reviewer's point of view the book contains enough suggestions that it could well be broken up into several textbooks so that each topic could be more thoroughly covered with adequate explanations, illustrations, and problems to assist the student.

Rose Ann Grundman
University of Illinois

Poisons, Properties, Chemical Identification, Symptoms, and Emergency Treatment, Vincent J. Brooks and Morris B. Jacobs. Second Edition. D. Van Nostrand Company, Inc., Princeton, New Jersey, 1958. xvi + 272 pp., 16 figs., 7 tbls. $6.50.

Those who found the first edition of this volume useful will welcome this second edition which includes descriptions of additional toxic agents and also an ingredient list which was particularly needed. These and other new inclusions should serve to make this little volume which was written for a very practical purpose even more useful.

The first edition, published in 1946, was designed for use as a handbook by those nonmedical personnel who may be first on the scene in cases of poisoning. Law enforcement officers, civil defense personnel, first aid training groups are among those who should find it useful as a textbook for nontechnical training courses and as a handbook for immediate reference. Since the outcome of a poisoning case may sometimes depend on the knowledge and discretion of the first responsible person on the scene, a book which would improve handling of such emergencies would be of considerable value.

Requisites of such a volume are that the information be quickly and easily available, that it be presented simply and nontechnically, and that it clearly indicate the limits of aid which could be provided by such nonmedical personnel. These requisites are well satisfied by this book. There is throughout emphasis on the need in such emergencies for professional assistance, and it is pointed out repeatedly that there are responsibilities which the nonmedical handler must not assume. The presentation is easily understood and information is made accessible by alphabetical (instead of pharmacological) arrangement and by tabulations of data such as in the "Information for Immediate Reference." The arrangement of material is orderly. The first two chapters are devoted to basic and general information on poisons and poison investigation with emphasis on responsibility of the police investigator. This is followed by a coverage of characteristics of poisons with identification and treatment measures included. The listing is not exhaustive nor is the information on any individual agent extensive, but most of the more commonly encountered poisons are included. A valuable addition in this second edition is an ingredient reference which is a list of familiar products and the toxic substances they may contain. Next are chapters on industrial hazards, poisons from plants, foods, snakes, and spiders, and a new chapter on radiation hazards and chemical warfare agents. The last two chapters deal with emergency techniques such as artificial respiration and shock treatment and with schematic analysis for poison identification. The appendix includes a glossary of terms and tables of weights and measures.

The coverage of toxic agents is not sufficiently complete to allow its use as a poison control center reference, and neither would it be satisfactory as a substitute for such a volume as Thienes & Haley's *Clinical Toxicology* for use as a textbook for technical and semitechnical courses. Looseness of classification and definition such as is occasionally encountered, while not detracting significantly from the book's usefulness, would probably be criticized by the technically trained reader who might object to the inclusion of acetylsalicylic acid and Benzedrine in a narcotic classification. There might also be justifiable criticism of the definition of an astringent as "a medicine that causes contraction of the muscle fibers and hardens tissue." The book, however, does provide a source of accessible, usable information on handling of many common poisonings and other emergency situations. In addition to its intended purpose, it would be a useful addition to pharmacy libraries and others in which information on toxic agents is often sought.

B. B. Williams
Alabama Polytechnic Institute

The Amphetamines, Their Actions and Uses, Chauncey D. Leake. First Edition. Charles C. Thomas, Publisher, Springfield, Illinois, 1958. xv + 167 pp., 1 fig., 3 tbls. $4.50.

Dr. Leake states that this book is a general introduction to the study of the amphetamines, and not a critical review of the area. He further comments that it is intended for the physician, lawyer, sociologist, or other intelligent person, and that the book will probably disappoint the pharmacologist. These remarks of the eminent author could serve as a short concise review of his own book.

Although the history, physical properties, absorption, excretion, pharmacology, pharmacodynamics, toxicity, and therapeutics of the amphetamines are discussed, I think it is the final chapter that provides the purpose for this book. In the last chapter Dr. Leake discusses the sociological aspects of the use and abuse of the amphetamines. The indiscriminate use of the amphetamines by truck drivers, athletes, and teenagers; the presence or lack of addiction; and legal restrictions are discussed. The publicity of the last few years fostered by the abuse of these drugs undoubtedly stimulated this chapter and the final form of the entire book. It is intended not for a pharmacological reference book, but rather a therapeutic guide for the physician, and a sociological guide in the medicolegal field. Indeed, the chapter on therapeutics is excellent, having great depth of material. The book then deserves a place in pharmacy libraries for the fore-mentioned uses.

The monoamine oxidase inhibitors are receiving widespread attention at this time, and the book might have served a more important function if it was a more extensive reference volume. One major defect in this book is the lack of a discussion of the chemistry of the amphetamines. The structure-activity relationships of these compounds are very important, too important to be left out of a major work. There are over 275 references in this book, but article reference in the text includes only the author's name and no identifying number to the bibliographical list at the end of the book. This becomes confusing whenever an author has more than one article. There is a need for a more complete discussion of the amphetamines, not a series of scattered review articles. It is hoped that Dr. Leake might soon modify this edition to provide, in his excellent writing style, a book that would fulfill this need more closely.

William J. Kinnard
University of Pittsburgh

Disinfection and Sterilization, G. Sykes. First Edition. D. Van Nostrand Company, Inc., Princeton, New Jersey, 1958. xviii + 396 pp., 17 figs., 50 tbls., 7 plates. $10.75.

Disinfection and Sterilization is the fourth publication in Spon's General and Industrial Chemical Series. The text is divided into Part I "Theory of Disinfection and Methods of Testing," Part II "Methods of Sterilization," Part III "Air Disinfection and Sterilization," Part IV "Disinfection of Viruses," Part V "Chemical Disinfectants," and Part VI "Preservation and Preservatives." Separate chapters under the major headings consider special aspects of each subject. Both the physical and chemical methods of disinfection and sterilization are discussed in this volume, and considering the voluminous literature that has accumulated in this field of microbiology, the material has been well selected. Wisely, no attempt has been made to incorporate material on the antibiotics since this is a subject of sufficient scope to warrant a separate volume.

The subject matter, introduced with a brief chapter on the use of preservatives and disinfectants in early recorded history, is followed by a consideration of the theoretical aspects of the subject. An adequate balance has been maintained throughout in discussion of theory, mode of action, and practical applications with reference to the various physical and chemical agents available for disinfection and sterilization purposes.

Worthy of particular mention are the chapters on "Radiation Sterilization," "Sterilization by Gases and Vapours," and "Disinfection of Viruses" which bring together up-to-date information on subjects that are becoming increasingly important. While much still remains to be determined in the way of more precise information on the inactivation of viruses, this latter chapter is of considerable interest.

Those concerned mainly with the practical aspects of disinfection and sterilization will find the chapters on "Methods of Testing Disinfectants" and "Preservation and Preservatives" particularly useful.

Part V, dealing with chemical methods of disinfection, discusses adequately the various agents available for this purpose.

This volume is a good addition to the limited number of standard references on this subject matter. Teachers, public health workers, and those engaged in related industrial fields will find this to be a useful reference book.

J. Douglas Reid
Medical College of Virginia

Acetophenetidin: A Critical Bibliographic Review, Paul K. Smith. Interscience Publishers, Inc., New York 1, New York, 1958. x + 180 pp., 11 figs., 7 tbls. $5.75.

The present volume constitutes the fourth in a series of monographs of the Institute for the Study of Analgesic and Sedative Drugs. Previous publications were concerned with acetanilid, salicylates, and antipyrine.

This well-written and organized review also includes references to N-acetyl-p-aminophenol, the major metabolite of acetophenetidin.

The book of twelve chapters based on 529 references treats of the following topics: history, physical and chemical properties, estimation in biological material, fats in the body, metabolism and intermediary products, antipyretic and analgesic actions, other therapeutic uses, effects on blood and organ systems, toxicology, tolerance, and habituation. Chronological organization of each section permits, in pertinent areas, a contrast of the deficiencies of earlier works with the more recent definitively documented reports. The format presented a special appeal to the reviewer in that the topics and their subdivisions are considered in the following interesting sequence: clinical observations, experimental studies in animals and humans, and a short concluding analytical summary. The salient points of the book summarized in the terminal chapter provide an effective orientation of the over-all aspects of the survey made.

The objectives of the volume "to make available the pertinent literature in convenient form" and "to aid future investigators by calling their attention to the inadequacies of past work so that these may be a guide to the planning of more definite experiments in the future" are effectively realized.

This volume definitely merits accession by pharmacy, medical, and dental libraries. Also it should prove useful for personal reference to pharmacologists, toxicologists, and clinicians.

C. T. Ichniowski
University of Maryland

Essential Fatty Acids, H. M. Sinclair, Editor. Academic Press, Inc., New York 3, New York, 1958. xviii + 268 pp., 94 figs., 59 tbls. $9.50.

This book titled *Essential Fatty Acids* is the proceedings of the Fourth International Conference on Biochemical Problems of Lipids held on July 15 to 18, 1957, at Oxford. It is composed of forty-two papers presented at the conference. According to the editor, "Some papers have been slightly shortened, but most are included with only editorial corrections."

The papers are found in the text according to sequence of presentation at the various sessions of the congress. There are thirteen papers on various of the Chemical Aspects, six papers on Absorption and Distribution (one in French), fifteen related to Biochemical Function, while the remaining eight papers are grouped under the heading of a "General Discussion of Essential Fatty Acids." Five of the latter papers are devoted to a variety of chemical methods, and the remaining three papers are concerned with fatty acid deficiencies.

All of the presentations are followed by a discussion, and in most instances several references are included.

In the past, devoted workers, by their

painstaking efforts, have contributed a great deal to knowledge about lipids and related complex chemical substances in plant and animal cells. The rapid advance in recent years can be attributed almost entirely to the development of the many new instruments. This book is a result of the advances made possible by these newer methods, suggestions, and theories resulting therefrom. Actually, from papers like one finds in this book come the new methods.

If any investigator or scholar is interested in the broad area of lipids, it is mandatory to be familiar with contributions such as these proceedings concerned with the fatty acids. However, to keep abreast of current works, it is necessary that we follow the current literature as well—for the singular reason that by the time such books are available, the techniques have already been altered, and existing theories are enjoying revision.

This publication is suggested reading for those interested in any aspect of lipid biochemistry. The nature of the publication makes it useful primarily as a reference work, but certainly necessary for your pharmacy library.

James E. Dusenberry
University of Arkansas

The Evaluation of Drug Toxicity, A. L. Walpole and A. Spinks, Editors. Little, Brown and Company, Boston, Massachusetts, 1958. v + 138 pp., 58 figs., 12 tbls. $5.50.

The contents of this book consist of the proceedings of a two-day symposium held during October, 1957, at Alderley Park, Cheshire, England. The symposium was held in conjunction with the formal opening of the pharmaceutical research laboratories of Imperial Chemical Industries Limited. Approximately forty-five scientists, the majority of whom were from Europe, participated in the symposium. These participants included authorities in the fields of pharmacology, toxicology, pathology, biochemistry, and physiology.

Nine papers, dealing mainly with basic principles and methods involved in the evaluation of the toxic effects of drugs, were presented during the two sessions. Two of the papers were also concerned with drug toxicity on specific organs, namely the liver and the bone marrow. The mechanisms of action of cytostatic agents such as the nitrogen mustards and the folic acid antagonists were especially well presented. Of considerable interest were the studies which revealed the liver toxicity of the pyrrolizidine (*Senecio*) alkaloids, termed "one-shot cirrhogenic agents," since a single administration of one of these alkaloids to an animal results in liver necrosis.

One of the most informative papers of the symposium was the presentation concerning sexual differences in the toxicity of chemical substances. Many examples of chemical agents for which differences in toxicity in male and female animals have been demonstrated are given, and the probable mechanisms accounting for the selective toxicity are discussed. The author also presents the results of investigations in animals which illustrate sex differences in therapeutic response to drugs. A review of the literature on the subject of differential toxicity of certain drugs for male and female animals, along with an extensive bibliography consisting of eighty-seven references, makes this article well worth reading by anyone concerned with the evaluation of drug action.

The authors of other papers present methods for the determination of the safety as well as the efficacy of new drugs. Considerable discussion was devoted to the abnormal and usually unpredictable reactions which are not related to the main pharmacological action of a drug. In this connection, the report on the progress which has been made in the production of drug allergies in animals and on the extrapolation of these results to man was of particular interest.

Some general principles involved in a blind screening program in which large numbers of essentially unselected compounds are evaluated for pharmacological activity are presented in another paper.

One of the important features of this book is the discussion which follows the presentation of each paper. These discussions add considerably to the value of the book. In one case, the written material acquired from the discussion period was more voluminous than that of the paper itself.

The book, as a whole, is well edited, and the index is commendable. One inconsistency was found with respect to bibliography. In all of the papers, with the exception of one, the references at the end of the papers are listed in the order in which they appear in the subject matter. In the one exception, the references are listed alphabetically according to the name of the author.

This book would be a valuable addition to the college of pharmacy library as well as to the personal library of any research worker involved with the evaluation of drug action.

Albert L. Picchioni
University of Arizona

Scale-Up in Practice, Richard Fleming, Editor. Reinhold Publishing Corporation, New York, 1958. iv + 134 pp. $4.50.

This unique volume is based on an "Experience in Industry Symposium" which was conducted under the auspices of the Philadelphia-Wilmington Section of the American Institute of Chemical Engineers and the School of Chemical Engineering of the University of Pennsylvania. The seven papers which make up the collection are aptly summarized by the editor in his reasons for this book. They are: (1) to review the general field of scale-up in a meaningful, practical way for the experienced engineer, but particularly for the younger engineer, (2) to

demonstrate the interrelationship of various facets of scale-up, (3) to introduce some recent developments in scale-up techniques, (4) to indicate some commonly encountered problems, and (5) to provide some ideas on the solution of common problems and some thoughts on the approaches to them. Although the book was written for engineers and some of the examples are not directly related to pharmaceutical manufacturing, the same basic problems are encountered by the pharmacist in industry, and a study of this text will enable him to work more closely with his fellow workers.

The discussion of the use of the pilot plant points out that the cost of this operation in terms of time, money, and talent must be justified by a realistic assessment of its utility. A successful pilot operation does not guarantee commercial success. However, it may be necessary in order to study scale-up problems.

The chapter on scale-up theory should be of special interest to the pharmaceutical educator and the industrial pharmacist. The author points out the limitations imposed by a lack of understanding of the true chemical and physical phenomena involved in many manufacturing processes, and the need for more basic research in this area. The lack of sufficient basic knowledge is often the reason for pitfalls in scale-up operations.

The analog computer is suggested by one author as a useful tool in scale-up operations. However, he points out that he does not mean to imply that the computer can replace the pilot plant, but that it can put the use of the pilot plant on a more rational and effective basis.

The process and business economics of scale-up are presented in two papers. Factors pertaining to economics of a product from the time it was nothing more than an idea until the product is marketed are discussed in a concise manner without a detailed discussion of methods.

In the opinion of one of the authors, good organization is not a guarantee of successful scale-up. However, it can improve the performance of the personnel involved. Since the problem of market scale-up is of prime importance, it must be closely coordinated with the over-all scale-up organization.

Two valuable features of this small volume are the references listed after several of the chapters and the questions and answers which follow each paper. *Scale-up in Practice* contains many useful ideas and is worthwhile reading for anyone teaching industrial pharmacy or contemplating a career in this field, as well as for those who have had extensive experience in manufacturing.

Louis D. King
Rutgers—The State University

Encyclopedia of Chemical Reactions, Volume VII, compiled by C. A. Jacobson, and edited by Clifford A. Hampel. First Edition. Reinhold Publishing Corporation, New York 22, New York, 1958. 480 pp. $12.75.

In the *Journal of Chemical Education 10,* 614, 1933, Prof. C. A. Jacobson discussed a proposed encylopedia of chemical reactions in which he would record every known and reported reaction with a brief description and reference to the original literature. The first volume, published in 1946, contained some 3,073 reactions of the elements from aluminum to bromine.

In Volume VII, there are 1,753 reactions of the elements: Strontium, Sulfur, Tantalum, Technetium, Tellurium, Terbium, Thallium, Thorium, Thulium, Tin, and Titanium. There are over 100 abstractors, and seven associate editors who have assisted the editor, Clifford A. Hampel, in this tremendous compilation. In addition to the arrangement of reactions by the elements in alphabetical order, there is an index to reagents and an index to substances obtained, both prepared by Elbert C. Weaver of Phillips Andover Academy, Andover, Mass.

As an illustration of the format used for each reaction we cite the following example on page 1 of Volume VII:

Sr

$CaCl_2$ VII-1

The equilibrium of strontium metal with molten calcium chloride is determined electrochemically at about 1000° C.

$$Sr + CaCl_2 \rightleftharpoons SrCl_2 + Ca$$

K. Jellinek, J. Czerwinski, J. Wolff, and G. Tomoff, Z. Elektrochem., *31,* 543 (1925).

(Abstractor No. 86)

This work will eventually cover the chemical reactions of all active elements, with the exception of the organic compounds of carbon. These volumes should constitute a valuable reference source to chemists in a wide variety of fields.

Lloyd E. Malm
University of Utah

Experimental Pharmacodynamics, T. Koppanyi and A. G. Karczmar. Second Edition. Burgess Publishing Company, Minneapolis 15, Minnesota, 1958. xvi + 258 pp., 32 figs., 11 tbls. $5.50.

The second edition of this laboratory manual has retained the same general arrangement as the first edition. The experiments are arranged in a series of twelve sections in the following order: Methods of General Pharmacology, Pharmacology of the Central Nervous System, Pharmacology of the Neuroeffector Systems, Pharmacology of Local Anesthetics, Pharmacology of Smooth Muscle, Histamine and Antihistaminic Agents, Pharmacology of the Uterus, Pharmacology of the Heart, Pharmacology of Diuretics and Anti-

diuretics, Pharmacology of Cathartics, Pharmacology of the Blood, and Chemotherapy. Following each section is a chapter entitled "Clinical Bearings" which correlates theory with practice; this greatly enhances the value of the information derived from the experiments performed by the students. Selected bibliographical references are included at the end of each chapter. The number of references is definitely limited but excellent for the most part.

The relatively few but noteworthy additions in the second edition include the following: a new section on selective (specific) psychotherapeutic drugs with four experiments demonstrating the properties of chlorpromazine, reserpine, benactyzine, meprobamate, mephenesin, and zoxazolamine; a new experiment on the comparative effects of oral preparations of a mercurial, a xanthine, and a carbonic anhydrase inhibiting agent in humans; an experiment illustrating the effect of Meratran and desoxyephedrine on spontaneous motor activity (mice and rats); and an experiment on the anorexigenic effects of Meratran and desoxyephedrine (cats).

Relatively few typographical errors, none of which are serious, were noted. The reviewer found some difficulty in following the authors' method of referring students to previous experiments, e.g. (cf. Section I-D and Experiment D2, and cf. Section I-D). The use of page numbers would have been more desirable and less time consuming.

The manual is of the loose-leaf type with spiral binding, which facilitates its usefulness in the laboratory. The grade of paper and the printing are far superior to the first edition.

Teachers of pharmacology would do well to inspect this manual carefully. It offers a wide diversity of well-planned experiments which will enable the student to establish a firm foundation in the basic principles of drug action. It should certainly be in the library of every college of pharmacy, and the reviewer highly recommends its use in pharmacology courses in colleges of pharmacy.

Howard L. Reed
Massachusetts College of Pharmacy

Retail Pharmacist's Handbook, H. G. Moss, Advisory Editor. George Newnes, Limited, London, W.C., England, 1958. xv + 464 pp., 53 figs., 3 tbls., 32 plates. $6.30.

This volume, intended as a reference book for retail pharmacists in England, is divided into three major sections. The appendices contain an extensive list of synonyms and trade names of drugs and a description of British pharmacy societies and organizations.

The first section (the shop) contains an exhaustive discussion of the physical layout and the necessary facilities for the pharmacy. Methods of heating and lighting are demonstrated. The layout of the various departments and the types of fixtures available for display are presented. The second section (the staff) deals with the recruitment and training of the necessary staff. The last section deals with the techniques of retailing and policy formation.

The editor states that in preparing this book, a two-fold need of pharmacy could be met. He believes that the handbook will increase the competence of present shop owners and aid future owners in establishing their shops. This book falls short of its aim. A few chapters are adequate in the treatment of the subject matter. The chapter on the surgical supply section of the pharmacy is extremely well done. All phases of the operation and physical layout are discussed including available training programs, physician-pharmacist relations, and the proper techniques of fittings.

A few chapters, particularly Chapters 1 through 6, delve too deeply into subjects which are not of prime importance to the pharmacist. The mechanics of heating and lighting are of more concern to those who will aid the pharmacist in building or modernizing the store. The specifications of fixture fittings and the qualities of commercially prepared showcases are of some importance but receive too much emphasis in a book of this nature. This book is intended for pharmacists, not carpenters.

The administration section is especially disappointing. While the treatment of stock control is very well handled, the other phases are inadequate. Problems facing the retail pharmacist are presented, but methods of solving them are omitted. The location of the pharmacy, for example, is treated in two short paragraphs. Its importance is noted, but the mechanics of finding such a location are deleted. Nor is there mention of what constitutes a good location. Very little is offered in improving the selection and training of the staff. What is presented is well done, but lacking in breadth. Public relations and consumer characteristics are but two of the important phases of retailing which have been omitted from the book.

Similar books on the retail activities of the pharmacist are more thorough and adequate. Little is presented to either present pharmacists or students that would be of value over and above the present texts. This book could only be recommended to those who are interested in comparing pharmacy operations in the U.S. with those in England.

Vincent R. Gardner
University of California

The Chemical Analysis of Foods and Food Products, Morris B. Jacobs, Third Edition. D. Van Nostrand Company, Inc., Princeton, New Jersey, 1958. xxiv + 970 pp., 88 figs., 106 + 3 tbls. $13.75.

The third edition follows closely in style and arrangement the previous editions of this standard reference for the food chemist. It has been thoroughly revised in the light of modern practice to include methods and

procedures which are actually used in industrial control and in governmental agencies for regulatory supervision. In addition, entirely new chapters on radiochemical determinations, pesticide residues, and artificial sweetening agents have been included. Like the previous editions, this publication is written with American food legislation in mind. However, some reference has been made to the food laws in other countries and the history of food legislation and adulteration in this country.

The book meets fully the needs of almost everyone interested in food analysis. It could serve adequately as a practical manual for use in routine chemical analysis and in general control work on food and food products. Its explanatory material is very complete, and explicit instructions on working methods are included in the one volume so that there is less need for additional reference publications. Entire chapters are devoted to such topics as food stabilizers, jams and jellies, meat products, etc. on which information is difficult to obtain, and which properly belongs in the modern literature of food analysis. The discussion of sampling includes both methods and instruments as well as other data required in food inspection. Many references are included to provide access to past work in any of the subfields.

The new chapters on radiochemical determinations, pesticide residues, and artificial sweetening agents make a contribution to the new edition. The chapter on radiochemical determinations includes a discussion on contamination of food by radioactive substances, uptake of radionuclides, radiotoxicity, counting, identification, and a complete method for the determination of strontium-90. Under pesticide residues, methods for the detection and determination of a number of pesticides such as the chlorinated organic compounds, parathion, and warfarin in food products are considered. Methods for the identification and detection of such compounds as saccharin, cyclamate, and dulcin are presented in the chapter on artificial sweetening agents.

The volume is designed for use as an educational text, as a practical manual for control work in regulatory laboratories, and as a standard reference for everyone interested in food products and their chemical analysis. The reviewer was very favorably impressed with the new edition. Although there should be little application for this book as a pharmacy text, it would have limited value as a reference text in pharmaceutical chemistry, and should be included in libraries serving schools of pharmacy.

Fred G. Drommond
University of Colorado

H. G. Wells once described civilization as a race between education and catastrophe. I believe we can afford to give long, serious contemplation to his epigram.

Milton S. Eisenhower, Am. J. Pharm. Ed., 8, 310 (1944)

NEW BOOKS

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New and Nonofficial Drugs, 1959, AMA. J. B. Lippincott Co., Philadelphia 5, Pennsylvania, 1959. xxvii + 687 pp. $3.35.

From Witchcraft to World Health, S. Leff and Vera Leff. The Macmillan Co., New York 11, New York, 1958. 236 pp. $4.50.

Psychotherapeutic Drugs, Ashton L. Welsh. Charles C. Thomas, Publisher, Springfield, Illinois, 1958. xiii + 139 pp. $4.75.

1958-1959 Year Book of Drug Therapy, Harry Beckman. Year Book Publishers, Inc., Chicago 11, Illinois, 1959. 569 pp., 43 figs., 2 tbls. $7.50.

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The Chemistry of Drugs, Norman Evers and Dennis Caldwell. Third Edition. Interscience Publishers, Inc., New York 1, New York, 1959. 415 pp. $12.25.

Applied Medical Library Practice, Thomas E. Keys, Catherine Kennedy and Ruth M. Tews. Charles C. Thomas, Publisher, Springfield, Illinois, 1958. xix + 495 pp., 12 figs. $10.50.

Sensitivity Reactions to Drugs, M. L. Rosenheim, R. Moulton, *et al.* Charles C. Thomas, Publisher, Springfield, Illinois, 1958. x + 237 pp., figs., tbls. $7.00

The Book of pH, R. B. Webber. The Macmillan Company, New York 11, New York, 1958. 111 pp., 40 figs., tbls. $6.00.

Modern Pharmacognosy, Egil Ramstad. McGraw-Hill Book Company, Inc., New York 36, New York, 1959. viii + 480 pp., figs., tbls. $10.50.

Pharmacology, J. H. Gaddum. Fifth Edition. Oxford University Press, New York 16, New York, 1959. xvi + 587 pp., 92 figs., 31 tbls. $9.50.

Psychiatry and the Public Health, G. R. Hargreaves. Oxford University Press, New York 16, New York, 1958. 1 + 118 pp. $3.00.

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Hormones and Atherosclerosis: Proceedings of the Conference Held in Brighton, Utah, March 11-14, 1958, Gregory Pincus. Academic Press Inc., Publishers, New York 3, New York, 1959. xvi + 484 pp., figs., tbls. $13.50.

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The Chemistry of Natural Products, Volume III, The Higher Terpenoids, P. de Mayo. Interscience Publishers, Inc., New York 1, New York, 1959. vii + 239 pp. $6.00.

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MISCELLANEOUS

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